Managing the future care burden of stroke

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Evaluation of an integrated care pathway including early hospital discharge with rehabilitation planning in the nursing home

Ron Heijnen

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Chapter 1

General introduction

Introduction

Strokes (or cerebrovascular accidents) have a profound effect on a person's life. Stroke survivors often experience particular impairments, disabilities and handicaps and are mostly in need of prolonged rehabilitation and care. Consequently strokes represent a large economic burden to society. For the European Union it is estimated that the annual direct costs for stroke amount to 26.6 billion euro [1]. In the Netherlands, stroke is among the top-five diseases in terms of financial burden, accounting for 2.3 billion euros a year, representing 2.5% of the annual total healthcare costs [2].

Although preventive actions to control vascular risk factors such as smoking, hypertension, hyperlipidaemia, overweight and diabetes have been used for quite some time, this probable will not weigh up to the effects of changes in demographics of the population on stroke prevalence [3,4]. With the aging of the population and a better survival of vascular diseases, it is estimated that during the next decade the number of stroke patients in the Netherlands will rise in men with 57% and in women with 37 % [2]. To handle the growing number of stroke patients, new developments are needed in every phase of the disease, aiming at achieving better treatment and rehabilitation results, a better organization of stroke care and optimising the use of available resources.

Developments in stroke treatment

Stroke survivors pass through three, partially overlapping, phases; the acute phase, the rehabilitation phase and the chronic phase. The acute phase starts with stroke onset and lasts till the patient is medically stable. Often, rehabilitation starts in the acute phase of the disease and continues till the chronic phase when it becomes clear with what impairments and handicaps the patient must learn to cope.

Acute phase of stroke

Direct treatment of stroke is most likely to be effective when patients are treated as soon as possible after symptom onset. Therefore, it's important to diagnose stroke patients as fast as possible to be able to initiate acute treatment directly [5]. Kwan et al. identified in a systematic review 54 studies that showed that not recognising stroke symptoms timely or not judging them as an emergency by patients as well as (para)medics, caused major delay in initiating adequate stroke treatment in a timely manner [6].

Positive effects of public awareness campaigns and training of (para)medics have been found by others [7]. Nowadays, in the Netherlands, public campaigns to make the population aware of the urgency of stroke symptoms are carried out by the Dutch Heart Association and (para)medics and hospital personnel are trained in stroke triage and

ambulance services treat stroke as an emergency. But the positive effects of these measures often decline rapidly and therefore should be deployed regularly.

Other strategies to reduce pre-hospital delays such as telestroke (remote assessment of stroke patients via audio-video conferences that assist local physicians in the decision-making process for acute stroke and Mobile Stroke Units (highly specialized ambulances equipped with CT scanners and a device for teleconsultation with the hospital neuroradiologist) are also being tested internationally. These strategies might be solutions for reducing pre-hospital delays in sparsely populated areas, where transport to a hospital takes vital time. In the Dutch situation where most hospitals are within a distance of less than 15 minutes' drive, these strategies seem less needed and are very costly.

Next to the necessity of a fast presentation at the hospital, a fast in-hospital diagnosis is equally important. The use of stroke protocols and the 24/7 availability of CT scans are essential for quick diagnosis. But, Leys et al in a study among 886 hospitals in 25 European countries found that 24/7 availability of a CT scan was lacking in 20% of the hospitals [8]. In the Netherlands most hospitals have a 24/7 access to a CT scan.

Besides, attempts in reducing prehospital and hospital delay, acute phase treatment options have been improved during the last decade. Intra Venous Thrombolysis (IVT) is now widely available as treatment for non-haemorrhagic stroke and reduces disabilities when initiated within 4.5 hours after the onset of symptoms [5]. Another innovation is intra-arterial thrombolysis (IAT) with mechanical thrombectomy, which achieves higher recanalization rates in large vessel occlusions, but is restricted by its limited availability and a longer time span that is required to initiate therapy. Intra-arterial therapy demands a specialised neuro intervention team being on demand 24/7. This limits the availability of this treatment to academic hospitals and some of the larger general hospitals. Despite clear evidence of the effectiveness of IVT, in 2005 only about 3% of European stroke patients received IVT [8]. In recent years the percentage of thrombolysis in the Netherlands has risen to 14% [9]. Although this is higher compared to the average European percentage for IVT, it only covers half of the number of stroke patients eligible for thrombolytic treatment, if delay could be avoided [10].

Rehabilitation phase of stroke

Stroke rehabilitation aims at reducing stroke-related disabilities. There is consensus that rehabilitation should start as soon as patients are medically stable and can be mobilized. The duration and intensity of rehabilitation are dependent on the level of disability, pre-morbid functioning and patients' motivation, and should therefore be highly individualised. Evidence suggests that early start of rehabilitation is beneficial for recovery [11] and that increased time spent on exercise result in significant improvements in walking ability and extended activities of daily living [12,13].

Meaningful Task Specific Training (MTST), a recently developed rehabilitation strategy for stroke patients, recommends to practice tasks using a functional approach, meaning that training should be targeted to goals that are relevant for the specific needs of the patient. It has proven effectiveness in motor recovery after stroke [14,15]. Another strategy, Constraint-Induced Movement Therapy (CIMT), recommends the forced use of the affected arm by restraining the unaffected side. It has resulted in an improvement in upper limb mobility and function in small studies, but the effects did not persist long after stroke [16]. A meta-analysis of virtual reality and video game applications showed that these novel and potentially useful technologies can be combined with conventional rehabilitation for upper arm improvement after stroke [17]. Another meta–analysis of studies that investigated the effects of repetitive transcranial magnetic stimulation (rTMS) on upper limb motor function in patients with stroke, found positive effect of this treatment as well [18].

This short overview shows that rehabilitation strategies for stroke patients are successful and new strategies are constantly being developed. But as rehabilitation should start as soon as a stroke patient is medically stable and mobilised, the availability of good rehabilitation facilities where rehabilitation can start as soon as possible is of outmost importance. In many European countries stroke patients' rehabilitation starts during hospital stay. However, Dutch hospitals in general are not very well equipped for this task. Therefore patients that cannot return home directly after their stroke are transferred to rehabilitation facilities in specialist rehabilitation centres or geriatric rehabilitation wards in nursing homes.

Chronic phase of stroke

In the chronic phase of the disease, it is attempted to maintain the results obtained in the rehabilitation phase and to regain the grip on life. In addition to this, stroke survivors in the chronic phase of the disease often still experience cognitive and communicational problems. Therefore stroke patients should structurally be screened after being discharged home, using special assessment instruments and, where needed, a structured referral system to other healthcare professionals should be installed to provide optimal care [19]. Control of risk factors is important, not only in primary prevention but also in secondary prevention after stroke. Mostly secondary prevention starts in the acute phase and continues throughout the rehabilitation and chronic phase of the disease. General practitioners in the Netherlands are urged by their professional standards to apply a strict cardiovascular risk management [20].

Developments in (organisation of) stroke care

Besides reducing pre-hospital delay, faster diagnosis, more effective treatment options and innovative rehabilitation strategies, much effort has been invested in improving organisation of stroke care services. Stroke units (in hospital settings that are entirely devoted to care for patients with acute stroke and are staffed by multidisciplinary teams with special knowledge and skills in stroke care) have been established and proven their value in reducing mortality, length of hospital stay and the subsequent need for long-term institutional care [21]. The underlying mechanism is believed to be the high caseload in a unit and highly trained professionals working together in a multidisciplinary team [22].

While stroke units have proven their value within the hospital setting, working together across organizational boundaries is also needed for stroke patients who in their recovery process often need further rehabilitation elsewhere. In contrast to many other European countries where stroke patient often receive rehabilitation in hospitals, in the Netherlands most stroke patients receive rehabilitation at home, in specialized geriatric rehabilitation wards of a nursing home or in specialist rehabilitation centres. Specialist rehabilitation centres are mostly meant for younger, more vital stroke patients who often still participate in employment, while older patients, often with multiple morbidities affecting their exercise tolerance, mostly rehabilitate in a geriatric rehabilitation facility of a nursing home [23,24]. Due to the complexity of problems a stroke patient may experience, in each of these settings (at home, in hospital, rehab centre or nursing home) a multidisciplinary team consisting of different professionals is needed especially in the rehabilitation phase. Such a multidisciplinary team generally consists of a specialized (rehab) physician, psychologist, physiotherapist, occupational therapist, speech therapist, dietician and trained nurses.

There are three options for rehabilitation of stroke patients in the Netherlands, representing three different care pathways.

1. Rehabilitation at home with outpatient care provided by therapists from primary healthcare services or by complementary day care rehabilitation in a hospital or nursing home
2. Inpatient rehabilitation in a geriatric rehab ward of a nursing home
3. Inpatient rehabilitation in a specialist rehabilitation centre

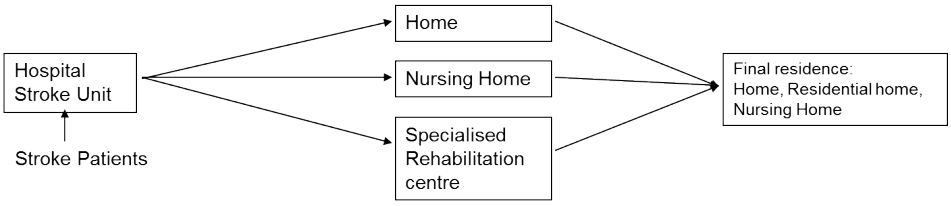

Figure 1. Showing the stroke patients flow through the different Dutch care setting

Organizing and coordinating the clinical pathway of stroke care is very important, as stroke patients tend to encounter many caregivers organized in different settings, often belonging to different organisations. Nowadays, in accordance with the Helsingborg Declaration on European Stroke Strategies, stroke patients in the Netherlands pass through a continuous care chain from the moment the stroke occurs [25]. This continuous care chain is often embedded in a setting of regional stroke services: "a regional healthcare chain of providers that collectively guarantees a comprehensive, expert-related care and treatment of stroke patients in all stages of the disease. The members of the stroke care chain jointly ensure a proper transfer of patients between the different care settings and also the quality of the chain in its entirety" [26].

The development of organised stroke care in the Netherlands, with specific hospital stroke units and regional stroke services, started in the 90s, stimulated by the Dutch Heart Association, which also released publications describing a step-by-step setup for stroke units and stroke services [27,28]. National guidelines were developed, providing stroke care professionals with evidence-based recommendations for delivering optimal stroke care [29,30]. Positive effects of stroke services in reducing hospital stay and costs in the Netherlands were found by Huijsman et al, when they compared stroke service care to conventional care [31]. Currently there are just over 100 general hospitals in the Netherlands, of which more than 70 participate in regional services for stroke patients. Although there are regional differences, most of these stroke services are collaborations between a general hospital, one or more nursing homes, a specialist rehabilitation clinic and community health care services (GP practices, home care organizations, etc.).

Shifting rehabilitation assessment to a nursing home

Comprehensive assessments are needed to tailor the best rehabilitation track to each individual patient. These assessments are often time consuming and need not necessarily be done in a general hospital. Given the growing pressure on acute care beds for stroke patients, this function could be outsourced to another setting which has all the facilities to rehabilitate.

Langhorne et al. showed in their review that appropriately resourced early supported discharge (ESD) services, with a programme of rehabilitation provided by a multidisciplinary team at home, for a select group of stroke patients can reduce long term dependency and admission to institutional care as well as length of hospital stay [32]. The group was selected by stroke severity and only mild and moderately severe stroke patients were included. Although Fens et al. showed that there is only limited evidence for the effectiveness of multidisciplinary care programmes for community living stroke patients after being discharged home [33], a recent Swedish study showed that when the multidisciplinary team is both responsible for co-ordination of the discharge and for the continued rehabilitation in the home environment, hospital stay is reduced, as well

as patients' care dependency related to their activities of daily living (ADL) and patients are more satisfied with care [34]. Although the effects of ESD seem positive, the moderate to severally ill stroke patients or those who lack caregivers at home, cannot participate, which is half of the stroke patients. Strikingly, little or no attention has been paid in these studies to shortening hospital stay by outsourcing functions that need not be done in an acute setting. Furthermore, reduction of hospital stay in the studies [32,34] was limited with average hospital stay of 20 and 15 days respectively, whereas the average acute phase period lasts five days only.

The mean duration of hospital stay in these studies differs from the mean hospital stay for stroke patients in the Netherlands, which nowadays approaches 9 days [35]. This could only have been achieved by the active participation of the Dutch nursing home in the Dutch stroke services, which have enabled transfer of the majority of stroke patients to a rehabilitation setting as soon as possible. Historically, Dutch nursing homes have been known as the institutions where the majority of older stroke patients that cannot return home are rehabilitated. In the Netherlands, 45% of stroke rehabilitation for especially older stroke patients takes place in specialized geriatric rehab wards of nursing homes. Dutch nursing homes employ their own multidisciplinary teams, consisting of elderly care physicians, paramedics and (neuro)psychologists. This implies that specially trained professional teams are available in geriatric rehabilitation wards to execute rehabilitation assessments and subsequent rehabilitation training [24]. In contrast, only 13% of the stroke patients in the Netherlands rehabilitate in specialist rehabilitation clinics [36].

Early discharge from hospital followed by a multidisciplinary assessment of stroke-induced disabilities and rehabilitation planning in a nursing home setting might be a solution, to further decrease the duration of hospital stay of Dutch stroke patients. Vos et al. studied the streamlining of hospital processes for stroke patients, and showed that a transfer of the assessment and treatment to the rehabilitation unit of a nursing home could reduce the delay, caused by duplication of work and unnecessary waiting times for assessment and treatment in hospital, even further [37]. By outsourcing functions that are not necessarily needed to be done in acute care facilities (hospitals) such as the assessment of the best rehabilitation track, hospital stay might be reduced to five days for every medically stable stroke patient.

Therefore in 2006 the stroke service Maastricht-Heuvelland introduced an innovative care model aimed at reducing hospital stay for stroke patients to five days, followed by assessment in a nursing home. The transition of the multidisciplinary assessment and treatment from the hospital to the nursing home should reduce the delay in the start of the rehabilitation track by withdrawing double work and unnecessary waiting, thereby reducing overall costs and stimulating patients' satisfaction.

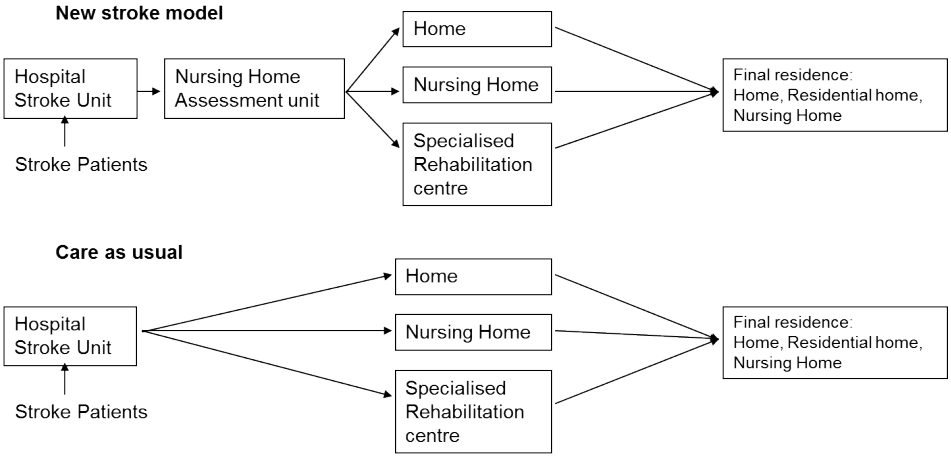

Figure 2. Showing the new stroke care model compared to care as usual

Evaluation of the new stroke model

This thesis reports on the design, conduct and outcome of an evaluation study of this new stroke care model.

The following research questions have been addressed:

1. What is the effect of early admission to and assessment in the nursing home of stroke patients on quality of life, functional outcomes, and satisfaction with care?
2. What is the estimated cost-utility and cost-effectiveness of the new stroke care model, from a societal perspective, in which all relevant costs and effects are taken into account, in comparison with the usual care provided by a regular stroke service?
3. What are the experiences and opinions of Dutch stroke patients regarding early hospital discharge and subsequent rehabilitation assessment and planning in a nursing home?

To answer these questions different functional outcomes such as activities of daily living (ADL), instrumental ADL, satisfaction with care and quality of life were measured. Also an economic evaluation was conducted on the cost effectiveness of the new stroke model and a qualitative study on patients' experiences with the new stroke model.

Outlines of the thesis

The structure of this thesis follows the respective phases of the study.
Chapter 1 is this general introduction.

Chapter 2 describes the development of stroke care in the Netherlands during the last 15 years, focusing on the development and implementation of a new stroke care model for the stroke service Maastricht-Heuvelland.

Chapter 3 presents the design of the non-randomised comparative study, as executed for this thesis, evaluating the functional outcomes, cost-effectiveness and experiences and opinions with an early transition from hospital to a nursing home for stroke patients.

Chapter 4 presents the results of the quantitative study on functional outcomes of geriatric stroke rehab in older stroke patients as part of the total study presented in Chapter 3. Functional outcomes were: quality of life, activities of daily living, impairment, cognitive functioning, instrumental activities of daily life, mood, satisfaction with care, caregivers' strain, length of stay, and medical complications of patients involved in the new care model as compared to regular stroke service care, without early discharge and assessment in a nursing home.

Chapter 5 presents the results of the economic evaluation of the undertaken non-randomised comparative study on the innovative model for stroke care.

Chapter 6 describes the results of the qualitative study on the experiences and opinions of Dutch stroke patients regarding early hospital discharge and subsequent rehabilitation assessment and planning in a nursing home as part of the total study presented in Chapter 3.

Finally, in chapter 7 (General Discussion), the results of the study are discussed and compared with previous studies. Methodological considerations are made and recommendations for future research are given.

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Chapter 2

Towards a better integrated stroke care: the development of integrated stroke care in the southern part of the Netherlands during the last 15 years

Ron WH Heijnen, Martien Limburg, Silvia MAA Evers, George HMI Beusmans, Trudy DEM van der Weijden, Jos MGA Schols

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Abstract

Introduction: Stroke care is complex and often provided by various healthcare organisations. Integrated care solutions are needed to optimise stroke care. In this paper, we describe the development of integrated stroke care in the region of Maastricht during the last 15 years.

Description of integrated care case: Located in the south of the Netherlands, the region of Maastricht developed integrated stroke care to serve a population of about 180,000 people. Integration was needed to improve the continuity, coordination and quality of stroke care. The development of integrated care in Maastricht was a phased process. The last phase emphasized early discharge from hospital and assessing the best individual rehabilitation track in a specialized nursing home setting.

Discussion and lessons learned: the development and implementation of integrated stroke care in the region of Maastricht led to fewer days in hospital, more patients being directly admitted to the stroke unit and an earlier start of rehabilitation. The implementation of early discharge from the hospital and rehabilitation assessment in a nursing home led to some unforeseen problems and lessons learned.

Introduction

There will be a marked increase in the number of stroke patients in Europe over the next decades [1]. By the year 2020, 250 per 100,000 inhabitants of the Netherlands will suffer from a stroke, often with subsequent permanent disabilities and handicaps as a consequence [2]. In terms of costs, stroke is among the most expensive diseases in the Netherlands with a total of 1.5 billion Euros accounting for 2.2 % of total annual health care costs [3]. Today, optimising stroke care in order to satisfy the demands for care, to enhance patient satisfaction and to be cost effective is an important field of research worldwide [4-6].

Several randomised controlled trials have already shown that stroke care organised in hospital stroke units leads to a reduction in mortality, less dependency on care and a decrease in long-term institutionalised care [7]. During the last decade in the Netherlands, in addition to the development of hospital stroke units, there has been a trend towards the development of integrated regional stroke services, leading to more integrated care for stroke patients, to increase satisfaction among patients and caregivers, and last but not least, also leading to more cost effective care [8]. This trend fitted also in an international trend towards integrated stroke care services [9,10].

Nowadays, in accordance with the Helsingborg Declaration on European Stroke Strategies, stroke patients in the Netherlands are part of a continuous care chain from the moment the stroke occurs [11]. This continuous care chain is often embedded in stroke services which are an organisational model of integrated care for stroke patients. Integrated care can be seen as the result of multi-pronged efforts to promote a coherent set of methods and models on the funding, administrative, organizational, service delivery and clinical levels, designed to create connectivity, alignment and collaboration within and between the cure and care sectors, to enhance quality of care and quality of life, consumer satisfaction and system efficiency for patients with complex problems which cut across multiple services, providers and settings [12].

The last decade before the millennium was extremely important for the development and innovation of stroke care in the Netherlands. Changes were necessary because healthcare in the Netherlands, as well as in many other western countries, was very fragmented. Stroke care lacked continuity, coordination, and communication often resulting in long hospital stays for stroke patients [13]. To improve this situation, a better coordination and cooperation between professional caregivers, often working for different care organisations, was strived for. The development of organised stroke care in the Netherlands, with specific stroke units and stroke services, started in the 90s, stimulated by the Dutch Heart Association, which also released publications describing a step-by-step setup for stroke units and stroke services [14,15]. National guidelines were developed, providing stroke care professionals with evidence-based recommendations for delivering optimum care [16,17]. To further facilitate the implementation of stroke services, the Dutch Institute for Healthcare Improvement started a series of break-

through projects for stroke care. In this nationwide effort, different regions were supported in implementing the integrated delivery of stroke service care [18].

Currently there are just over 100 general hospitals in the Netherlands, of which more than 70 participate in providing services for stroke patients. Although there are regional differences, most of these stroke services are collaborations between a general hospital, one or more nursing homes, a rehabilitation clinic and home care organisations. Most of the Dutch stroke services are affiliated with a knowledge network ("Kennisnetwerk CVA Nederland") that strives towards implementing the goals set by the Helsingborg declaration.

Besides providing chronic continuing care for somatic and psychogeriatric patients, nursing homes in the Netherlands have a specific geriatric rehabilitation function, whereas rehabilitation centres focus primarily on the rehabilitation of younger patients, who can cope with a more intense rehabilitation programme. Accordingly, Dutch nursing homes play a substantial role in integrated stroke care service, especially in the rehabilitation of elderly stroke patients. After hospital discharge, 32% of stroke patients return to their home, 9% are discharged to a rehabilitation centre and 31% are rehabilitated in a nursing home [8]. Dutch nursing homes employ their own nursing, paramedical and psychosocial staff and, in contrast to other western countries, the medical treatment of nursing home patients is an officially recognized medical discipline, and nursing home physicians are specifically trained in this specialization. The nursing home sector in the Netherlands is mainly a non-profit sector, covered by a mandatory (national) insurance system for all citizens, the Exceptional Medical Expenses Act [19]. In 2001, with extra funding from the Exceptional Medical Expenses Act the stroke rehabilitation function of nursing homes was stimulated even further.

In the Netherlands, the development of integrated stroke care has stimulated the promotion of integrated care for other specialist services as well. Especially in the comprehensive care for diabetic patients and in the care for frail and disabled elderly, which often have complex care needs due to multiple co-morbidities, integrated care programs are being developed and implemented now nationwide [20,21].

In comparison to the approaches in integrated stroke care in other countries, for instance the development of hyper-acute stroke units (HASUs) in Great Britain, the Dutch experience differs because of the unique abilities and positioning of Dutch nursing home care. HASUs are developed to enable more patients being treated with thrombolytic drugs by concentrating acute care for stroke patients in a few specialised centres, enabling admission and treatment of stroke patients 24 hours a day, 7 days a week. Patients admitted to a HASU will receive acute care for up to 72 hours after which they will be transferred to a stroke unit, also in the hospital setting, for further care and rehabilitation.

In the region of Maastricht, stroke patients are able to receive acute stroke care 24 hours a day, 7 days a week in the academic hospital and subsequently they are transferred to a nursing home for further assessment and rehabilitation.

This paper describes the development and changes over time of integrated stroke care in the south of the Netherlands, specifically in the region of Maastricht. In this development process, several phases can be distinguished which give insight into national and local factors that play a role in the integration of stroke care in the Netherlands. Parts of the changes in this development process were related to evaluations performed. In the last phase of this development, the stroke service underwent the last reformation, which will be described in detail.

Towards integrated stroke service care in the Maastricht region

The Maastricht region has about 180,000 inhabitants; it is situated in the southernmost part of the Netherlands, close to the borders of Belgium and Germany. Maastricht has only one hospital, with 715 beds; this hospital provides standard medical care for the region, and also serves as an academic centre for about 1.1 million inhabitants. In 2010, 365 stroke patients were admitted to the academic hospital and received care within the stroke service Maastricht. The mean age of these stroke patients was 70 years (standard deviation 15).

Integrated care for stroke patients was not available in Maastricht before 1996. Stroke patients were treated by various individual health care providers without any coordination. In that period, the average hospital stay for stroke patients was 28 days, during which the patient received little rehabilitation therapy. In view of the importance of starting rehabilitation as soon as possible after stroke, this represented suboptimal care for recovery [22].

Since 1996, integrated stroke care services in Maastricht as well as in other regions started to thrive, due to the expected effectiveness of thrombolysis as a treatment for stroke [23]. This encouraged hospitals to enlarge their stroke unit capacity, enabling every stroke patient to be admitted directly to the stroke unit after the onset of stroke. In order to better coordinate the flow of stroke patients through the health care chain, the integrated care model for stroke patients was designed, later evolving into the Stroke Service Maastricht. The Stroke Service Maastricht involves collaboration between general practitioners, neurologists, rehabilitation specialists, nursing home physicians, psychologists, nursing staffs, district nursing, physiotherapists, speech therapists, occupational therapists and dieticians working for the academic hospital, the nursing home, the rehabilitation centre and in primary healthcare.

The total development process was characterised by four phases. During the first phase, which started in 1996, the focus was on achieving a better degree of cooperation between caregivers within the academic hospital itself. Next to this, caregivers of regular community care were involved. A protocol was developed in which the care process was described from the moment of stroke onset until discharge to the home

situation and a collaborative training programme for visiting nurses, physiotherapists and general physicians was set up.

The goals set were:

1) The development of a care process in which as many stroke patients as possible could be admitted directly to the stroke unit of the academic hospital, as quickly as possible after the onset of stroke.
2) The duration of hospital stay for stroke patients should be as short as possible.
3) Community care, treatment and follow-up should start immediately after hospital discharge.

The second phase in the development of the Stroke Service Maastricht started in the year 2000. During this phase the emphasis was on the structured participation of the nursing homes in the region. The two nursing homes which in fact already participated in stroke service, but not in a structured way, were willing to reserve a total of 21 beds for older stroke patients who could be discharged from the academic hospital but couldn't yet return home. The two nursing homes committed themselves to admitting stroke patients within 10 days after referral from hospital. To facilitate this fast transition, an agreement had to be reached with the central indicating commission for care (CIZ). In the Netherlands, the CIZ is charged with the assignment of care provided by nursing homes. Normally this means that patients need to be visited by a CIZ employee before being approved for rehabilitation in a nursing home. During such a visit the CIZ employee judges the clinical information from the hospital related to the functional status and prognosis of the patient. However, this may take a couple of days and lead to an unnecessary delay in the care process. Therefore it was agreed that stroke patients could be admitted directly to the nursing home, without waiting for a CIZ employee visit. The official indication could be provided at a later date.

This phase in the development of the Stroke Service Maastricht in fact ended with the results of a study conducted in Maastricht. This study compared stroke service care in Maastricht with care for stroke patients in a region without a stroke service. The results showed that 6 months after stroke 64% of the surviving patients in Maastricht could be discharged to their own homes, in comparison with 42% in the care as usual group, which was more fragmented and without any coordination [24].

In 2002 the third phase started. In this phase specific attention was paid to further improving the quality of stroke care by implementing all relevant recommendations from the most recent national guidelines on rehabilitation after stroke [17]. In addition much work was done on improving communication and coordination between professional caregivers within and amongst organisations participating in the Stroke Service, by improving for instance, the quality of the transitional information. Agreement was also reached on which clinimetric tests should be used throughout the care chain. Clinimetric tests like the Assessment of Motor and Process Skills (AMPS), Barthel Index (BI) or the mini-mental state examination (MMSE) provide information on different func-

tional levels. Using the same clinimetric tests at set times makes it possible to monitor a patient's progress and improve communication between caregivers about the condition of the patient as well as about changes in this condition. Furthermore, care after discharge from the nursing home was improved as well, and structural education on the handling of psychological and behavioural effects of stroke was initiated for the patients and their caregivers.

After this phase, the development of organised stroke care in the region of Maastricht had resulted in a complete stroke service model, with the participation of an (academic) hospital, a large nursing home organisation, a rehabilitation centre and a home care organisation and the model complied with the required model of stroke services in the Netherlands. Figure 1 depicts the model of Dutch stroke care in that time.

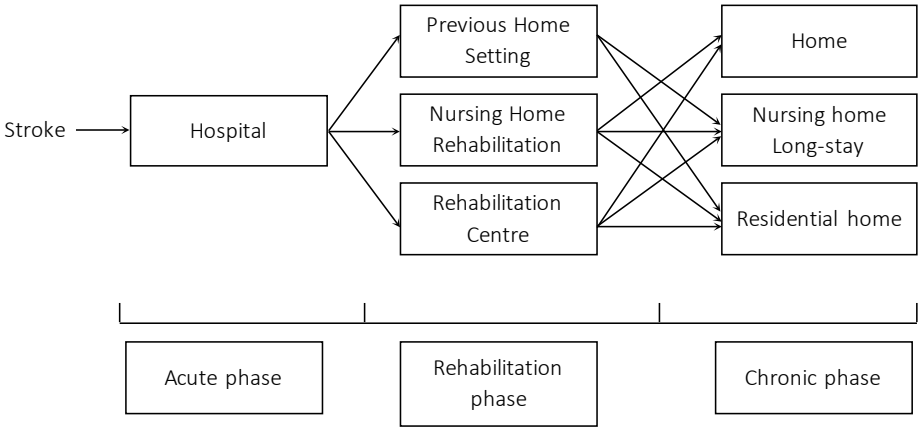

Figure 1. Stroke care model of the Stroke Service Maastricht in 2004

The fourth phase was developed after an evaluation of the integrated stroke service in 2004, which will be discussed below.

Evaluation of the Integrated Stroke Service Maastricht

Integrated stroke care in the region of Maastricht is constantly being monitored, not only by an implemented electronic registration system that enables the gathering of a set of important indicators on the quality of stroke care, but also by means of scientific studies which are regularly being carried out [24, 25, 26]. All evaluations are initiated by a steering committee consisting of representatives of all health organisations participating in the stroke service.

In 2004, the integrated stroke care service in Maastricht and its surrounding region was analysed scientifically for the first time, because the average hospital stay of a

stroke patient still amounted to 12 days and not all stroke patients could be admitted directly to the hospital's stroke unit. The study, carried out by Vos et al [25] consisted of a process analysis, the identification of bottlenecks, the setting of goals and the selection as well as the implementation of coordination measures. The effects were measured by means of length of hospital stay and the number of patients admitted to non-specialised wards. Vos et al identified the following barriers:

A first barrier involved the insufficient capacity of the stroke unit of the academic hospital. Because of this, 31% of stroke patients were not admitted directly to the stroke unit. A second barrier was presented by the time needed for initial diagnostic tests (such as: CT-scan, Echo Doppler of the carotid artery, Cardiac Echo, or a 24- ECG) and medical consultations to be carried out in the academic hospital. These diagnostic tests and consultations should have been carried out at the time of admission, but actually this took approximately three days. A third barrier was formed by the low frequency of the multidisciplinary meetings, which took place only once a week. The multidisciplinary meetings are meant to evaluate the triage process and to determine the further rehabilitation track for each individual patient. The low frequency of the meetings caused an increase in the length of hospital stay for patients who otherwise could have been discharged home earlier. A final barrier was formed by the waiting times for admission to the rehabilitation clinic and the nursing homes. All these barriers resulted in an average hospital stay of 12 days, of which on average 3 were superfluous from a medical perspective.

The identification of these barriers mandated a further redesign of the Integrated Stroke Service Maastricht. This can be seen as the fourth phase in the development of the Stroke Service. Even more than in the past, the emphasis in this phase was laid on faster discharge from the academic hospital by better coordination and planning of initial diagnostic tests and consultations.

Apart from this, the multidisciplinary assessment and its related multidisciplinary meetings, to determine the best rehabilitation track (triage phase), which originally took place in the hospital, were transferred to the nursing home. In addition, the existing protocol for the rehabilitation of stroke patients in the nursing home had to be extended to incorporate an initial multidisciplinary assessment.

Because patients would be discharged much faster from hospital in the adapted model, the flow of patients to the nursing home was expected to increase, and therefore more nursing home beds were needed for assessment and rehabilitation. Accordingly, nursing home management decided to enlarge the nursing home stroke ward from 21 to 30 beds. Moreover, all 30 stroke beds were positioned in a single nursing home ward.

To assure that this nursing home stroke ward was able to receive new stroke patients at all times, the ward's patient outflow had to be guaranteed. Therefore, stroke patients who had finished their rehabilitation in the nursing home but could not be discharged home were given priority in finding a permanent bed for continuing long-

term care in a residential or nursing home ward of the participating nursing home organisation.

Description of the Redesigned Integrated Stroke Service Maastricht

The redesigned Integrated Stroke Service Maastricht involves a critical care pathway for stroke patients admitted to the academic hospital. In this redesigned care pathway every stroke patient is admitted directly to the hospital stroke unit. Most are referred by general practitioners and brought to the emergency ward of the hospital by ambulance, but some come on their own initiative without first consulting a general practitioner. In the emergency ward acute diagnostic tests take place. In cases of confirmed stroke, the patient will be admitted to the stroke unit of the academic hospital, where further diagnosis and treatment, including thrombolysis if indicated, are performed.

Subsequently, the redesigned care model consists of a strict discharge regime for all stroke beds from the neurology ward of the academic hospital. All necessary tests and treatment in the hospital should be performed within 5 days after admission. Thereafter, in principle, all patients, regardless of their age, will be discharged to the stroke ward of the nursing home, where a comprehensive assessment takes place (Figure 2). Only patients who can be discharged home within 5 days after admission and those who are medically unstable will not be transferred from the hospital to the nursing home within 5 days.

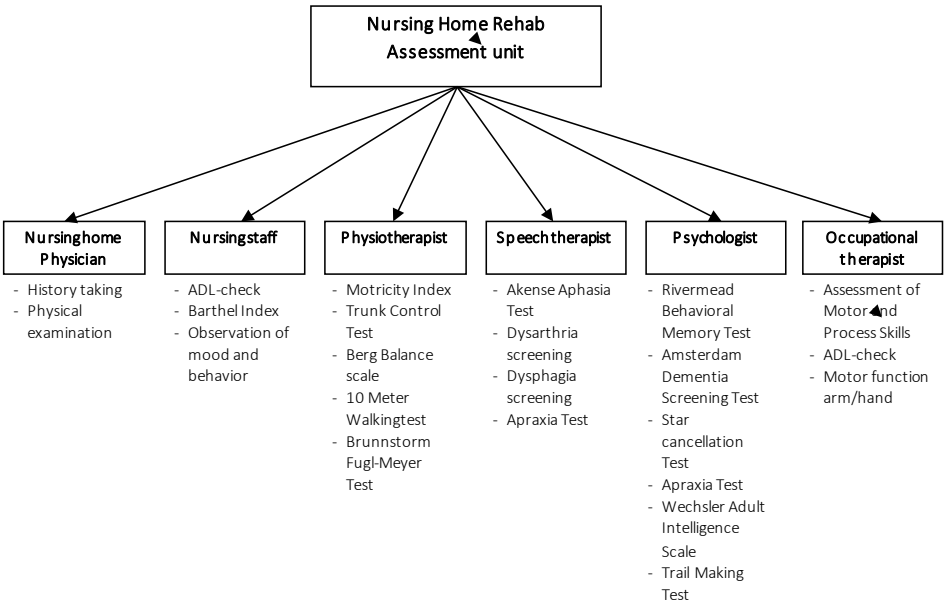

Figure 2. Content of assessment at the nursing home assessment unit

The nursing home physician examines each patient immediately on arrival in the nursing home and initiates the assessment program. In this program a multidisciplinary team consisting of a psychologist, physiotherapist, occupational therapist, speech therapist and trained nurses examine the patient, performing a structured assessment protocol. Following this assessment, the team will meet within five days of the patient's admission to make recommendations for a rehabilitation program specifically tailored to the patient. Their advice will be based on admission and discharge criteria formulated by the various care providers participating in the Stroke Service. There is a structured possibility for the nursing home physician to consult a rehabilitation physician if needed. After the multidisciplinary meeting, the patient and his family will be informed about the proposed rehabilitation track; if they approve this track can be started.

There are three options for a rehabilitation track after the assessment in the nursing home.

1. Rehabilitation at home with home care and outpatient treatment provided by therapists from primary healthcare or day care rehabilitation in a hospital or nursing home.
   In case of fast functional recovery after stroke with the availability of adequate informal care and a safe environment at home.
2. Inpatient rehabilitation in a nursing home.
   In case stroke patients need a prolonged rehabilitation trajectory of a lower intensity.
3. Inpatient rehabilitation in a rehabilitation centre.
   In case the patient is in need of high intensity rehabilitation, and/or reintegration into regular work activities.

The Redesigned Integrated Stroke Service Maastricht is displayed in Figure 3.

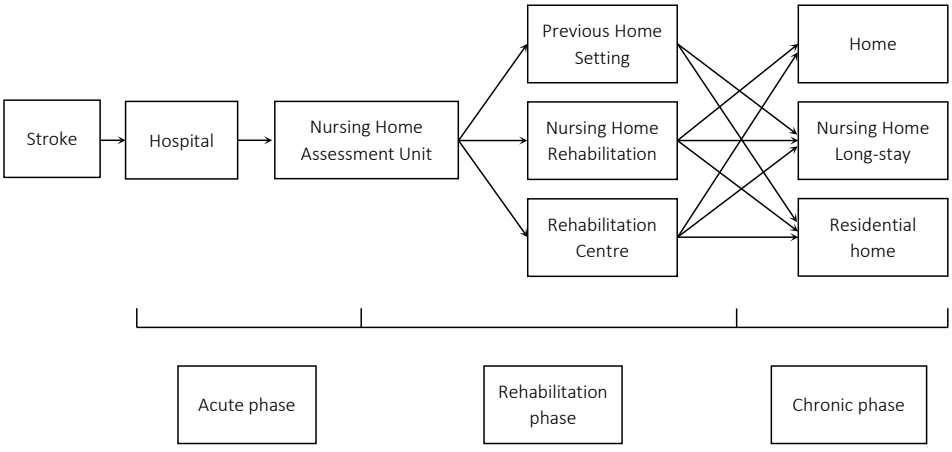

Figure 3. The Redesigned Integrated Stroke Service Maastricht

This new care model for stroke patients was implemented in January 2006. During the first four months following implementation, data on the duration of hospital stay and admission directly to the stroke unit were collected for all stroke patients admitted to the academic hospital. The data showed that the duration of hospital stay had decreased to an average of 7.3 days and that the percentage of stroke patients who could not be admitted directly to the stroke unit had decreased to 2% [25]. Although this study showed a decrease in hospital stay and in the number of patients who could not be admitted directly to the stroke unit, the study did not take into account functional outcomes at patient level, quality of life and satisfaction with care.

Accordingly, the question remained whether in the new care model hospital stay was decreased without having a negative effect on other outcomes, such as the patient's functional level, quality of life or satisfaction with care. To answer these questions and to depict the total costs of this stroke care model, a cost effectiveness study is presently investigating the cost-effectiveness of the new care model [26]. This cost effectiveness study consists of an effect evaluation, an economic evaluation and a process evaluation. The design of this study involves a non-randomised comparative trail for two groups. The participants are followed for six months from the time of stroke. The mean outcome measures of the effect evaluation are quality of life and daily functioning. In addition an economic evaluation will be performed from a societal perspective. A process evaluation will be carried out to evaluate the feasibility of early discharge and assessment in a nursing home, as well as the experiences and opinions of patients and professionals.

Lessons learned

Before the implementation of the last redesigned stroke service model could begin, stroke care professionals of different backgrounds worked together to define appropriate adaptations of the initial stroke care protocol. In the new stroke care protocol, admission and discharge criteria were formulated for every link in the stroke care chain and agreement was reached on what tests should be done by which professional at what point of time. Furthermore, the information needed for the effective transition of patients throughout the care chain was evaluated and adjusted. Despite this careful preparation of the new stroke care protocol, the implementation brought forward some unforeseen problems. These problems were expressed in contacts with the different stake holders of the stroke service including patients and health care professionals.

First, the relative unfamiliarity of patients in the region of Maastricht and surroundings with the possibilities of assessment and rehabilitation in a nursing home caused a problem. Experiences with the first patients showed that in general patients didn't associate a nursing home with a quick discharge to their own home, but with a long or even permanent residency.

Therefore, some patients initially refused to their admission to the nursing home, but the hospital staff almost always succeeded in convincing them that this was the fasted way of starting rehabilitation. To change the patient's views and to actually show the possibilities of rehabilitation in a nursing home, a better way of providing information to patients and their caregivers was arranged. Verbal information given by the hospital nursing staff was supplemented by a DVD which showed the different rehabilitation tracks in detail. This DVD was given to every stroke patient who was admitted to the academic hospital and their primary caretaker.

Second, for the healthcare professionals working in the new stroke care model, early discharge from the academic hospital in combination with assessment in the nursing home implied a shift in tasks. Some professionals in the hospital lost their function in the assessment of stroke patients, when that was adopted by the professionals in the nursing home. As an earlier study by van Raak showed, this can be perceived as a threat by some of the hospital professionals [27]. For instance, the rehabilitation specialists in the hospital, who lost their coordinating role in the triage process, had some difficulty in adapting to this shift, particularly in relation to their decision-making power. In the old stroke care model, the rehabilitation specialist coordinated the decision on the type of rehabilitation track the stroke patient should follow after hospital discharge. In the new care model, the triage function of the academic hospital and the related multidisciplinary meetings were transferred to the nursing home team, supervised by the nursing home physician, with only a consulting role for the rehabilitation specialist. In practice this occasionally caused a difference in opinion, but subsequent adequate communication always led to a patient friendly solution.

Third, in the new model, the patient's transfer from the hospital to the nursing home is coordinated by the "discharge office of the academic hospital". A staff member of this office visits the patients prior to discharge, informs them of the rehabilitation track to be followed and arranges transfer, if needed. This function is vital for maintaining an adequate and continuous patient flow. But because the two employees consigned to this task initially hadn't coordinated their working hours, transfers could not always be planned in time. A better coordination of working hours solved this problem.

Fourth, another unforeseen problem was that the transport of the patients from the academic hospital to the nursing home hadn't been discussed with the ambulance service before the start of the new care model. Because the ambulance service maintained previously made arrangements, patients often arrived at the nursing home too late in the day to start the assessment on arrival. This problem was solved by making good additional arrangements with the ambulance service.

Fifth, labelling extra beds for stroke patient assessment in the nursing home meant that the hospital became less "vulnerable" to fluctuations in patient flows, in contrast to the nursing home, which needed extra capacity to cope with patient flow fluctuations. In times of low demands for stroke beds, the hospital was able to fill its beds with other neurology patients whereas the nursing home could not. In order to fulfil their part in

the stroke service, the management of the nursing home was willing to keep their designated beds, even when unoccupied, and bear subsequent financial losses. Nowadays these problems are solved by additional reimbursement for nursing homes.

It can be concluded that by gradually altering the structure of the conventional stroke service model we have created a new care model that, based on evidence elsewhere, we expect to shorten the duration of hospital stay and lead to lower costs. Moreover this new model may have positive effects on patients' functional outcomes, quality of life and satisfaction with care.

Currently we are investigating the added value of this new model. If the expected positive effects are established, the model might also be tested in integrated care models related to other chronic diseases. In this respect we can think of patients with chronic heart failure or of elderly patients who often stay hospitalised unnecessarily long because of their multimorbidity and complex care problems.

Optimizing integrated stroke care means knowing and using the abilities of different healthcare providers for a common purpose. In the Netherlands, nursing homes with their unique ability to equally participate in the rehabilitation of mostly elderly patients, take away the pressure from acute care providers, not only as part of a stroke service but also as part of other integrated care models.

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Chapter 3

The cost effectiveness of an early transition from hospital to nursing home for stroke patients: design of a comparative study

Ron WH Heijnen, Silvia MAA Evers, Trudy DEM van der Weijden, Martien Limburg, Jos MGA Schols

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Abstract

Background: As the incidence of stroke has increased, its impact on society has increased accordingly, while it continues to have a major impact on the individual. New strategies to further improve the quality, efficiency and logistics of stroke services are necessary. Early discharge from hospital to a nursing home with an adequate rehabilitation programme could help to optimise integrated care for stroke patients. The objective is to describe the design of a non-randomised comparative study evaluating early admission to a nursing home, with multidisciplinary assessment, for stroke patients. The study is comprised of an effect evaluation, an economic evaluation and a process evaluation.

Methods/design: The design involves a non-randomised comparative trial for two groups. Participants are followed for 6 months from the time of stroke. The intervention consists of a redesigned care pathway for stroke patients. In this care pathway, patients are discharged from hospital to a nursing home within 5 days, in comparison with 12 days in the usual situation. In the nursing home a structured assessment takes place, aimed at planning adequate rehabilitation. People in the control group receive the usual care. The main outcome measures of the effect evaluation are quality of life and daily functioning. In addition, an economic evaluation will be performed from a societal perspective. A process evaluation will be carried out to evaluate the feasibility of the intervention as well as the experiences and opinions of patients and professionals.

Discussion: The results of this study will provide information about the cost effectiveness of the intervention and its effects on clinical outcomes and quality of life. Relevant strengths and weaknesses of the study are addressed in this article.

Background

By the year 2020, 250 per 100,000 patients in the Netherlands will suffer from a stroke, and in many instances this will result in permanent disabilities and handicaps [1]. Substantial evidence is available showing that hospital stroke units reduce mortality, dependence and institutionalisation [2] and that better outcomes are associated with comprehensive and early assessment of stroke patients [3]. It is also suggested that organised integrated stroke care and the use of early supported discharge services for stroke patients are less expensive than general medical care, due to a reduction in hospital stay [4,5]. However there are very few data on the cost effectiveness of integrated stroke care from a societal point of view [6].

In the Netherlands 32% of stroke patients return directly to their home after hospital stay, 9% are discharged to a rehabilitation centre and 31%, mainly elderly stroke patients, are discharged to a nursing home for rehabilitation [7]. Consequently, contrary to nursing homes in many other countries, Dutch nursing homes fulfil an important role in the rehabilitation of stroke patients [8]. The mean duration of hospital stay of stroke patients in 2004 was 12.6 days [9]. Demographic developments, the increased incidence and prevalence of stroke, the emergence of disease management programs, and changes in the structure of the Dutch health care system have led to new strategies to further improve the quality, efficiency and logistics of care processes. Optimizing stroke services involves: a) faster admission of stroke patients to the hospital, leading to improved chances for effective intervention, b) early discharge from hospital, with an adequate plan for rehabilitation and c) improving care after discharge to home.

In 2006, these developments led to a redesign of the Stroke Service Maastricht Heuvelland. The essentials of this redesign are: stroke patients are admitted to Maastricht University Medical Centre for a maximum of 5 days for diagnosis, early intervention and stabilization, after which they are discharged to a special assessment and rehabilitation ward in a nursing home. In this nursing home, stroke patients undergo a structured multidisciplinary assessment, lasting a maximum of 5 days, and take part in their first rehabilitation activities. During assessment, the appropriate follow-up treatment is determined. Patients are then admitted to the follow-up setting for rehabilitative care. This means discharge to either their own home situation, to a specific rehabilitation hospital, or continued stay in the nursing home for prolonged rehabilitation or continuing stay.

Cost effective integrated stroke care requires a high degree of coordination between professionals in hospitals, nursing homes and home care, a high quality integral assessment in the nursing home and a system of adequately timed patient transitions.

The principal expectation is that the redesigned process of the Stroke Service Maastricht Heuvelland will lead to cost effective care, with expected improvement in the quality of care as well.

This article describes the design of a longitudinal comparative study, evaluating the cost effectiveness of an early discharge to and assessment of stroke patients in a nursing home, as part of a redesigned integrated stroke care programme, in comparison with a comparable stroke service region, where the redesign has not been implemented.

The research questions in this study are:

1. What is the effect of early admission to and assessment in the nursing home on functional outcomes, quality of life, and satisfaction with care in comparison with the usual care provided by a stroke service? [Effect evaluation]
2. From a societal perspective, what is the incremental cost effectiveness of early admission to and assessment in the nursing home, in comparison with the usual care provided by a stroke service? [Economic evaluation]
3. Research questions for the process evaluation
   a) Is the new care pathway executed on time according to the protocol? [Process evaluation]
   b) What are the experiences and opinions of patients and professionals about the newly developed care pathway? [Process evaluation]

Methods and Design

Study Design

We will conduct a comparative study with retrospective and prospective parts, in which we will compare the redesigned stroke service in the intervention region with a comparable region that offers the usual stroke care.

Ethical approval and informed consent

The Medical Ethical Committee of the University of Maastricht has granted ethical approval. The trial is registered as ISRCTN58135104. An information brochure will be given to all eligible patients. At inclusion, patients will be informed personally and also by means of written information on all aspects of the project. The privacy of the participating patients is protected, and all data will be coded and processed anonymously. It will be made clear in the informed consent form that each patient can terminate his or her participation in the trial at any moment without the care being influenced.

Study population

The patient population consists of consecutive stroke patients who are admitted to the hospitals in both research regions during a period of 18 months. The diagnosis of stroke

will be made by a neurologist based on patient history, physical examination and neuro-imaging. Patients will be eligible to participate if they meet the following criteria: over 18 years of age and fluent in Dutch. Exclusion criteria are: a life expectancy of less than a few days, a previous diagnosis of dementia, hospital discharge to home within a few days and occurrence of complications which require prolonged hospital care. Patients suffering a recurrent stroke during their participation in this study will not be asked to participate a second time.

Sample Size

The primary goal of this study is to achieve cost reduction without loss of quality of life. Based on an earlier study among stroke patients [10], we estimate a difference in utilities indicating health related quality of life between the 2 regions. In this earlier study by Olsen, the utility difference based on the EuroQol was 0.11. Based on a power of 80%, alpha 0.05, our study will need a sample size of 111 participants per group.

We expect a 25% drop-out of patients between inclusion and the follow-up meeting 26 weeks later, due to premature termination of the trial participation, inability to co-operate in the trial, or mortality [11]. To correct for this expected drop-out, the number of patients included will be increased to 139 participants per group.

Intervention

The intervention (figure 1) consists of the execution of a redesigned care pathway for stroke patients admitted to the Maastricht University Medical Centre. Every patient with a suspected stroke will be analysed in the emergency ward. In case of a stroke, the patient will be admitted to the stroke unit of the hospital, where, if indicated, thrombolysis will be followed by further diagnosis and treatment. The new aspect of the critical care pathway consists of a strict discharge regime in the neurology department of the hospital. All necessary testing and treatment in the hospital can be performed within 5 admission days, after which patients may be discharged if medically stable. The underlying assumption for the design is that hospitals are specialized in acute care and treatment and do not provide optimal rehabilitation facilities. From a cost effectiveness point of view as well, it seems more appropriate to provide rehabilitation in a centre specialised for this purpose.

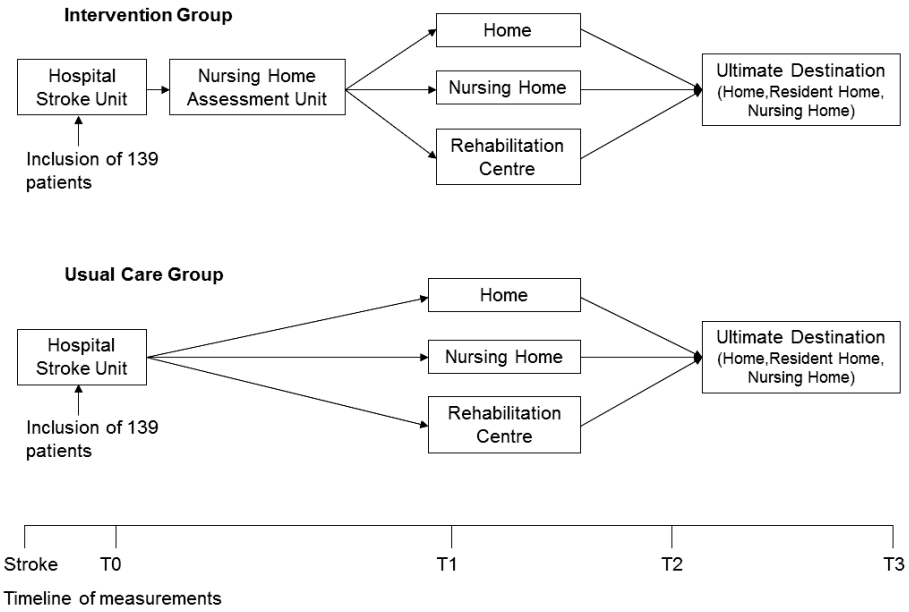

Figure 1. Flowchart of the study

In the redesigned care pathway, after 5 days all stroke patients are discharged to a nursing home with a specialised assessment unit, resulting in a tailored rehabilitation programme. Only patients who can be discharged directly to their home within five days, or patients with complications requiring prolonged hospital care, will not be referred to the specialised nursing home unit. The nursing home physician examines each patient immediately on arrival in the nursing home and initiates the assessment program. In this program a multidisciplinary team, consisting of a psychologist, physiotherapist, occupational therapist, speech therapist, and trained nurses, examine the patient by means of a structured assessment protocol. Following assessment, the team will meet within five days of the patient's admission to make recommendations for the best rehabilitation program. Their advice will be based on admission and discharge criteria formulated by the various care providers participating in the stroke service. A structured possibility for the nursing home physician to consult a rehabilitation physician, if needed, is arranged. After the multidisciplinary meeting the patient and his family will be informed about the proposed rehabilitation track and after their approval this track can be started.

There are three options for rehabilitation after the assessment.

1. Rehabilitation at home with outpatient care provided by therapists from primary healthcare or day care rehabilitation in a hospital or nursing home
2. Inpatient rehabilitation in a nursing home
3. Inpatient rehabilitation in a rehabilitation centre

Usual care

The redesigned stroke service provided by the Stroke Service Maastricht Heuvelland, the intervention region, will be compared to "care as usual" provided by the stroke service in the Eindhoven area.

In the Stroke Service Eindhoven stroke patients are admitted to the stroke unit of the Catharina hospital in Eindhoven, where diagnostic tests, treatment and observation take place. During the patients' stay in the hospital, an assessment is performed in order to determine the best suitable rehabilitation facility for the stable patient. A physiotherapist, an occupational therapist and trained nurses carry out the assessment; if necessary they are supported by a speech therapist or a psychologist.

On the basis of admission and discharge criteria formulated by the various care providers who participate in the Stroke Service Eindhoven, the patient can be discharged to home, to a rehabilitation centre or to one of four nursing homes participating in the stroke service. The mean duration of the hospital stay in Eindhoven is 10 days. Consequently, the main differences in care arrangements between the experiment and the control region are the early hospital discharge and the structured assessment in the nursing home.

Effect evaluation

The primary outcome measures of the effect evaluation are quality of life and activities of daily life (ADL). Quality of life is measured by means of the Stroke Adapted Sickness Impact Profile 30 (SA-SIP 30) [12] and ADL by means of the Barthel index (BI) [13,14].

Secondary outcome measures are: instrumental activities of daily living (IADL) measured by means of the Frenchay Activity Index (FAI) [15], handicap measured by means of the Modified Rankin Scale (MRS) [16]. Cognitive functioning is measured by means of Mini Mental State Examination (MMSE) [17], Apraxia Test (AT) [18] and Star Cancellation Test (SCT) [19]. Anxiety and depression are measured by the Hospital Anxiety and Depression Scale (HADS) [20] and the patients' satisfaction with stroke care is measured by means of the Satisfaction with Stroke Care Questionnaire (SASC-19) [21]. The strain on caregivers is measured by the Caregivers Strain Index (CSI) [22].

Other secondary outcome measures are medical complications occurring within 3 months after stroke. The following diagnoses are regarded as medical complications: a new stroke, epileptic seizures, pneumonia, urinary tract infections, fractures, bedsores, myocardial infarct, heart failure and atrial fibrillation. The data on medical complications will be collected from the patients' files.

Besides the primary and secondary outcome measures we assess some background variables which are considered to be predictors, confounders or effect modifiers. The following personal characteristics are assessed: age, sex, socio-economic status, risk factors, co-morbidity, stroke location and stroke severity measured by the National

Institute of Health Stroke Scale (NIHSS) [23]. All background variables are measured at baseline.

Economic evaluation

The economic evaluation compares costs and outcomes of stroke care given in the Stroke Service Maastricht Heuvelland to care as usual provided by the Stroke Service Eindhoven. The economic evaluation will involve a combination of a cost-effectiveness analysis (CEA) and a cost-utility analysis (CUA). In a CEA effects are presented in clinical outcomes.

The primary outcome measure of the cost-effectiveness analysis will be the SASIP-30. Within the cost-utility analysis, outcomes will be measured by means of the standard Dutch version of the EuroQol (EQ-5D) [24]. This is a self-administered questionnaire, which will be completed together with the cost questionnaire at 12 weeks and 26 weeks.

Both generic quality of life, as well as utilities, will be derived by means of the EQ-5D. The EQ-5D is chosen because it is a widely used quality of life instrument. The EQ-5D contains 5 dimensions of health-related quality of life; mobility, self-care, daily activities, pain/discomfort and anxiety/depression. Each can be rated at three levels: no problems, some problems and major problems. The 5 dimensions can be added to comprise an overall health state. This health state will be translated into a number, a utility. Utility values can be calculated for these health states, using preferences elicited from a general population, the so-called Dolan algorithm [25]. The utility values derived from the Dolan algorithm will be used to compute Quality Adjusted Life Years (QALYs). The Dolan algorithm has been established using a general population from the UK. Recently a Dutch algorithm has become available, and this will be used in the sensitivity analysis [26]. The utilities at the two time points are used to compute a Quality Adjusted Life Years (QALY) score by means of the area under the curve method. Furthermore, the EQ-5D consists of a visual analogue scale (VAS) ranging from zero (worst imaginable health state) to 100 (best imaginable health state). The reliability and validity of the EQ-5D has been established [27]. The primary outcome measure for the cost-utility analysis will be Quality Adjusted Life Years (QALYs), based on the EuroQol utility scores [24,27]. In the CUA, the incremental cost-effectiveness ratio (ICER) will be expressed as the incremental costs per QALY. This economic evaluation will be performed from a societal perspective, which implies that all relevant costs and outcomes will be taken into account.

Process evaluation

The process evaluation consists of two parts. The first part of the process evaluation consists of assessing whether care after the redesign was performed in the time

planned. For this part of the process evaluation, the patients' files will be screened for protocol violations related to the discharge time from hospital, according to protocol, and the duration of assessment in the nursing home. If possible the reasons for these protocol violations will be collected from the patients' files as well.

The second part assesses how patients, their personal caregivers and professionals experience care after the redesign. Data will be collected from 20 patients and from their personal caregivers. Data will also be collected from 20 professionals working in the redesigned care system. The data will be collected by means of semi-structured in-depth interviews. The patients and professionals will be selected by means of purposeful sampling, to ensure that the interviewees are heterogeneous on relevant determinants such as age, severity of disease, level of functioning, housing situation (living alone, stairs, etc.).

The patients will be interviewed at home or in the institution were they are being cared for. To ensure the open character of the interviews they will be held by a person who is not related to the direct project group. All interviews will be audiotaped and transcribed verbatim.

Instruments

The instruments used in this study are shown in Table 1.

Stroke Adapted Sickness Impact Profile 30 (SA-SIP30)
The Stroke Adapted Sickness Impact Profile measures sickness specific quality of life in stroke patients and is a modified version of the 136-item SIP. This instrument was developed primarily to overcome the length of the original SIP, which is its major disadvantage. The SA-SIP30 is a 30-question instrument with eight subgroups, created by eliminating the most irrelevant questions from the initial test. The higher the score the lesser the quality of life after stroke [12].

Barthel index (BI)
The Barthel index is a generic questionnaire which consists of 10 items measuring activities of daily life (ADL) and mobility. A high score on the Barthel index corresponds with a high degree of independence concerning the activities of daily life [13,14].

Frenchay Activities Index (FAI)
The Frenchay Activities Index is a stroke specific instrument to assess functional status. The FAI is comprised of 15 items, each concerning an activity that requires some decision making and organisation on the part of the patient [15].

Modified Rankin Scale (MRS)
The Modified Rankin Scale is a widely used instrument that measures levels of handicap. It defines 6 levels of disability, ranging from 0 (no symptom) to 5 (severe disability, bedridden, incontinent and receiving constant nursing care and attention) [16].

Mini Mental State Examination (MMSE)
The Mini Mental State Examination is the most widely used instrument to screen for cognitive dysfunction. The MMSE assesses orientation, memory, attention, language, and constructive functions. The MMSE consists of 20 items with a maximal total score of 30 [17].

Apraxia Test (AT)
The Apraxia Test is a short and easy test to measure the degree of apraxia in stroke patients. It consists of two subtests, one designed to evaluate the use of objects and another to evaluate the ability to imitate gestures. The maximum score for the total test is 90 [18].

Star Cancellation Test (SCT)
The Star Cancellation Test is the most sensitive single test for neglect. Depending on the number of missed stars the magnitude of neglect can be measured [19].

Hospital Anxiety and Depression Scale (HADS)
The Hospital Anxiety and Depression Scale was developed to identify anxiety and depression among patients. It is divided into an anxiety subscale and a depression subscale, each containing seven intermingled items. The maximum score is 47. The higher the score the greater the possibility of anxiety or depression [20].

Satisfaction with Stroke Care Questionnaire 19 (SASC-19)
The 19-item version of the Satisfaction with Stroke Care Questionnaire is comprised of eight items measuring satisfaction with inpatient stroke care, and eleven items measuring satisfaction with stroke care after discharge [21].

Caregivers Strain Index (CSI)
The Caregivers Strain Index is a 13-item instrument that ascertains strain on care givers across domains of employment, finances, physical health, and social relationships. A positive answer to 7 or more of the items reflects a more than average strain on caregivers [22].

The National Institute of Health Stroke Scale (NIHSS)
The National Institute of Health Stroke Scale provides a measure of severity of symptoms associated with cerebral strokes. It measures level of consciousness, visual fields,

motor response, sensation, language and neglect on weighted scales. The NIHSS can be used with persons of all ages, including geriatric patients, who have had a stroke [23]. The higher the score, the more severely affected is the patient.

European Quality of Life instrument (EQ-5D)

The European Quality of Life instrument (*EQ-5D*) is a well-known generic instrument measuring health-related quality of life. It includes 5 dimensions (mobility, self-care, daily activities, pain/discomfort and anxiety/depression) and a visual analogue scale that evaluates patients' perceived health status [24-27]. Each dimension can be rated at three levels: no problems, some problems and major problems. The 5 dimensions can be summarized in a health state.

Cost Questionnaire

We will assess intervention costs, healthcare costs, patient and family costs, and costs outside the healthcare sector. For this study we will develop a cost questionnaire especially designed for this group, based on existing questionnaires [28,29], which identify all relevant costs aspects.

Table 1: Overview of instruments per time point

Instrument	Time after stroke			
	T0	T1	T2	T3
	< 1 week	4 weeks	12 weeks	26 weeks
SA-SIP30			X	X
Barthel index	X	X	X	X
Frenchay Activities Index	X			X
Modified Rankin Scale	X	X	X	X
Mini Mental State Examination	X			X
Apraxia Test	X			X
Star Cancellation Test	X			X
Hospital Anxiety and Depression Scale		X		X
SASC-19	After every discharge			
Caregivers Strain Index				X
EQ-5D			X	X
Cost Questionnaire			X	X

Instruments used for the screening process, the clinical outcome assessment and the economic evaluation. In Table 1 an overview of all assessments per time point is shown.

Effect analysis

For the analyses we will use SPSS statistical software and Excel (for the Bootstraps). Missing data on the item level will be handled using SPSS missing value analysis. If con-

siderable data are missing related to specific instruments, imputation will be considered.

A baseline analysis will be performed to examine the comparability of groups at baseline for both costs and outcomes. If necessary, methods will be applied to correct for differences in baseline [30]. A Kolmogorov-Smirnov test will be performed to investigate whether the data are normally distributed. If the data are distributed normally, our primary analysis will start with a t-test. If data are skewed, the primary analysis will be based on a non-parametric test for assessing two independent samples, i.e. a Mann–Whitney U test.

As it is known that in non-randomised comparative studies, variations in case mix between centres can influence the interpretation of outcome data [31], we would like to explore this in further analysis. Therefore, for each of the data sets collected at all measurement points, differences in outcome variable between the 2 regions will be tested using multiple MANCOVAs, entering various indicators of case mix as co-variates, i.e. age, gender, stroke severity. In addition, information on possible confounding factors and effect modifiers will be collected and analysed.

Economic analysis

Total costs will be estimated using a bottom-up (or micro-costing) approach, where information on each element of service used is multiplied by an appropriate unit cost and these are added to provide an overall total cost [32]. We will assess intervention costs, healthcare costs, patient and family costs, and costs outside the health care sector. For this study we will use a cost questionnaire especially designed for this group, based on existing questionnaires [28,29], which will identify all relevant cost aspects.

To measure the actual use of resources, data will be obtained using combined sources (registrations by professionals and cost questionnaire). Resources used relating to the interventions will be an estimation of the time spent by the professionals, based on prospective registration in a random sample. All use of resources by the patient and their family, in and outside the health care sector, will be measured by means of a cost questionnaire, in which the resource utilization is recorded at 12 weeks and 26 weeks during the follow-up period. These sources of information will be combined.

The valuation of healthcare costs and costs to patient and family will be based on the updated Dutch manual for cost analysis in healthcare research [33,34]. This manual recommends using standardized cost prices. In brief, the manual recommends that prices of informal care will be based on shadow prices for unpaid work (meaning a standard cost price based on general hourly wages). Costs of transport will be calculated as the mean distance per destination multiplied by standard cost prices. Costs of medication will be calculated using prices based on Daily Defined Dosage (DDD) taken from the Dutch Pharmacotherapeutic Compass [35], indicating the mean medication usage per adult per day. Productivity costs will be calculated by means of the friction

costs method, based on a mean added value of the Dutch working population. The friction costs method takes into account production losses confined to the period needed (usually 90 days) to replace a sick employee. In case of uncertainty we will use a conservative estimation (i.e. the lowest cost price). Cost prices will be expressed in 2010 euros. If necessary, existing cost prices will be updated to 2010 using the consumer price index (CPI) [33,34].

Despite the usual skewness in the distribution of costs, arithmetic means are generally considered the most appropriate measure to describe cost data [36,37]. Therefore, arithmetic means (and standard deviations) will be presented. In case cost data are skewed, non-parametric bootstrapping will be used to test for statistical differences in costs between the intervention and control group. Non-parametric bootstrapping is a method based on random sampling with replacement based on the individual data of the participants [38]. The bootstrap replication will be used to calculate 95% confidence intervals around the costs (95% CI), based on the 2.5th and 97.5th percentiles. If cost data are distributed normally, t-tests will be used.

The incremental cost effectiveness ratio (ICER) will be determined on the basis of incremental costs and effects of the intervention compared to care as usual. The cost effectiveness ratio will be stated in terms of costs per outcome rate; the cost utility ratio will focus on the net cost per QALY gained. The ICER will be calculated as follows. ICER = (Ci-Cc) / (Ei-Ec), where Ci represents the total costs of the intervention group at the 26-weeks follow-up, Cc the total costs of the care as usual group at the 26-weeks follow-up, Ei the effects at the 6-month follow-up for the intervention group and Ec the effect at the 26-weeks follow-up for the care as usual group. The robustness of the ICER will be checked by non-parametric bootstrapping (1000 times). Bootstrap simulations will also be conducted in order to quantify the uncertainty around the ICER, yielding information about the joint distribution of cost and effect differences. The bootstrapped cost-effectiveness ratio will be plotted subsequently in a cost-effectiveness plane, in which the vertical line reflects the difference in costs and the horizontal line reflects the difference in effectiveness.

The choice of treatment depends on the maximum amount of money that society is prepared to pay for a gain in effectiveness, which is called the ceiling ratio. Therefore, the bootstrapped ICERs will also be depicted in a cost effectiveness acceptability curve showing the probability that the intervention care is cost effective using a range of ceiling ratios.

Process evaluation analysis

The process evaluation will be analysed mainly by means of qualitative data analysis. The interviews will be analysed by directed content analysis [39]. After identifying and coding text passages relevant to the research question, the descriptive codes will be compared and contrasted by sequential and retrospective searching within and among

the interviews. The codes will be grouped into larger themes, explored further, structured, refined and reduced in number. Data will be collected and analysed concurrently, allowing both expected and emergent themes and ideas to be incorporated and explored in subsequent interviews. Units of text referring to similar codes will be grouped and categorized systematically by one central coder, who is coding all the interviews. For the richest interviews – in the opinion of the interviewer - a full open coding of the transcript will be independently executed by the central coder and the interviewer. Differences in coding will be resolved by consensus discussion face-to-face or by phone. The central coder will then analyse the other interviews in the subset of interviews done by the one interviewer, and the interviewers will check the coding.

Discussion

Implementation of the redesigned stroke care pathway in the Stroke Service Maastricht Heuvelland started in 2006. It has yet to be seen whether the introduction of this care pathway has led to improvement of the quality of care for stroke patients. The results of this study may provide information about the cost effectiveness of the intervention and its effects on clinical outcomes and quality of life. In this respect the relevance of this study lies in the fact that it is one of the first studies assessing the cost effectiveness of a stroke service from a societal point of view. In case of proven cost effectiveness, arguments for implementing the intervention into usual healthcare are clear and evident.

A weak point of this study is the possible bias of non-randomisation. In our study randomisation is impossible as the location of the stroke patient necessarily determines to which hospital the patient will be admitted, and in order to prevent contamination effects, only one treatment will be offered in one hospital. If our intervention appears to be cost effective, the next step will be broader implementation in more nursing homes. In addition, it will be possible to perform a cluster randomised trial to obtain even more evidence on the effectiveness of the interventions. A strong point of the study is the standardised and consequent use of validated measurement instruments, which make the characteristics of the study population accessible for further studies.

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Chapter 4

Is early hospital discharge after stroke combined with assessment in the nursing home safe and acceptable?

Ron WH Heijnen, Trudy DEM van der Weijden, Silvia MAA Evers, Martien Limburg, Bjorn Winkens, Jos MGA Schols.

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Abstract

Background: A new stroke care model has been developed aiming at the early hospital discharge of stroke patients to a nursing home for systematic assessment with subsequent planning for rehabilitation. Our hypothesis was that this new model for stroke care improves the delivery of care without affecting quality of life, functional outcomes and satisfaction with care.

Design: A non-randomised comparative trial.

Setting: Two Dutch stroke services in the regions of Maastricht and Eindhoven.

Participants: Acute stroke patients, over 18 years of age.

Intervention: Hospital discharge of stroke patient within 5 days to a nursing home, followed by a systematic multidisciplinary assessment in a specialised nursing home assessment unit to determine the optimal rehabilitation track. Usual care consists of an average of 10 days of hospital care, followed by less extensive assessment.

Measurements: The primary outcome measures were quality of life and activities of daily living. The primary and secondary outcomes - impairment, cognitive functioning, instrumental activities of daily life, mood, satisfaction with care, caregivers' strain, length of stay, and medical complications - were assessed using validated instruments.

Results: 239 acute stroke patients participated in this study: 122 in the intervention and 117 in the control group. We did not succeed in implementing early discharge from hospital, although the systematic assessment in the nursing home was accomplished. No clinically relevant differences were found between the groups for functional outcomes, quality of life or satisfaction with care. In comparison with the control group, a trend towards reduction in length of nursing home stay was found in the intervention group.

Conclusion*:* Although the new care model failed to implement early discharge, more stroke patients in the intervention group were assessed by a multidisciplinary team in a nursing home in comparison with the usual care group, where more patients were discharged home after their initial hospital stay.

Introduction

Strokes have a profound effect on a person's life and also present a large economic burden to society [1]. Changes in the delivery of health care, driven by the need to optimise the delivery of care and reduce costs, have resulted in shorter hospital stays and a decrease in the number of acute care beds in hospitals [1]. It is estimated that in the Netherlands the prevalence of strokes will rise until 2025 [2]. Accordingly, managing the growing number of strokes demands creative solutions that will not have a negative impact on stroke outcomes.

Hospitalisation often leads to worsening of overall health condition by iatrogenic induced disability, therefore early hospital discharge is important, especially for the elderly [3]. Early discharge from a hospital followed by assessment of stroke-induced disabilities and rehabilitation planning in a nursing home setting might be a solution for the Netherlands, where a considerable part of stroke rehabilitation for older stroke patients already takes place in nursing homes [4]. Therefore the stroke service Maastricht Heuvelland introduced an innovative care model aimed at reducing hospital stays for stroke patients to 5 days, followed by assessment in a nursing home. A hospital stay of 5 days can be achieved, as shown earlier by Vos et al [5]. The development and implementation of this care model are described elsewhere [6].

The positive effects of stroke unit care on the reduction of mortality, length of hospital stay and the number of long-term care admissions have been well-documented [7]. Earlier studies on early supported discharge, with rehabilitation beginning in the acute phase continued with home-based rehabilitation, showed a decrease in the length of hospital stay and a reduction of institutional care, with no effect on outcomes such as activities of daily living, instrumental activities of daily life or cognitive functioning [8].

Results of other forms of stroke care organisation, including various types of home-based rehabilitation, have been inconclusive. A recent review showed little evidence of the effectiveness of these interventions on functional outcomes such as activities of daily living and quality of life in stroke [8]. In accordance with these findings, our hypothesis was that the new care model, consisting of early hospital discharge in combination with assessment and rehabilitation planning in a nursing home, may optimise care delivery and decrease the length of hospital stay even further, without negatively affecting functioning, quality of life or satisfaction with care.

We performed a non-randomised comparative study, consisting of an effect evaluation, an economic evaluation and a process evaluation. The innovative care model provided by the stroke service Maastricht Heuvelland, the intervention region, was compared to "care as usual" provided by the stroke service in the Eindhoven area. This paper describes the effect evaluation of the new care model on quality of life, functional outcomes, and satisfaction with care. To our knowledge, no study has addressed the

effects of early discharge from hospital with subsequent assessment and rehabilitation planning in a nursing home on functional outcomes in stroke patients.

Methods

Patients

The patient population consisted of consecutive stroke patients admitted to hospital in both research regions during a period of 18 months. The diagnosis of stroke was made by a neurologist, and was based on the patient's history, physical examination and neuro-imaging. Patients were eligible to participate if they met the following inclusion criteria: over 18 years of age and fluent in Dutch. Exclusion criteria were: a life expectancy of less than a few days, a previous diagnosis of dementia, hospital discharge to home within a few days and occurrence of complications requiring prolonged hospital care. Each patient with a recurrent stroke during the study period, could be included only once: i.e. these patients were not asked to participate a second time. Detailed information about the research protocol is published elsewhere [9].

Intervention

The intervention involved a critical care pathway for stroke patients admitted to the academic hospital in Maastricht. In this care pathway, every stroke patient is admitted directly to the hospital stroke unit. In the emergency ward, acute diagnostic tests are performed. In case of a confirmed stroke, the patient will be admitted to the stroke unit of the hospital, where further diagnosis and treatment, including thrombolysis if indicated, are performed.

Subsequently, the care model consists of a strict discharge regime from the neurology ward of the academic hospital. All necessary tests and treatment in the hospital are planned to occur within 5 days after admission. Thereafter, in principle, all stroke patients, regardless of age, will be discharged to the stroke ward in the nursing home, where a comprehensive assessment takes place. Only patients who can be discharged home within 5 days after admission and those who are medically unstable will not be transferred from the hospital to the nursing home within 5 days. A skilled elderly care physician examines each patient immediately on arrival in the nursing home and initiates the assessment program. In this program, a multidisciplinary team consisting of a physiotherapist, occupational therapist, psychologist, speech therapist and trained nurses examines the patient, performing a structured assessment protocol. Following this assessment, the team meets within five days of the patient's admission to make recommendations for a rehabilitation program specifically tailored to the patient. After

this multidisciplinary meeting, the patient and his family will be informed about the proposed rehabilitation track; if they approve, this track will be started.

There are three options for rehabilitation after the assessment in the nursing home.

1. Rehabilitation at home with home care and outpatient treatment provided by therapists from primary healthcare or day care rehabilitation in a hospital or nursing home
2. Inpatient rehabilitation in a specific nursing home rehabilitation ward
3. Inpatient rehabilitation in a specialised rehabilitation centre

Usual Care Group

In the Stroke Service Eindhoven, stroke patients are admitted to the stroke unit of the Catharina Hospital in Eindhoven, where diagnostic tests, treatment and observation take place. During the hospital stay a less extensive assessment is performed in order to determine the best suitable rehabilitation facility for the stable patient. A physiotherapist, an occupational therapist and trained nurses carry out the assessment; if necessary they are supported by a psychologist or a speech therapist.

On the basis of admission and discharge criteria formulated by various care providers, the patient can be discharged home, to a rehabilitation centre or to one of four nursing homes participating in the stroke service. The mean duration of the hospital stay in Eindhoven is 10 days [10]. Consequently, the main differences in care arrangements between the experimental and the control region are the early hospital discharge and the structured multidisciplinary assessment in the nursing home in the intervention region.

Outcome Measures

The primary outcome measures were quality of life and activities of daily life (ADL). Quality of life was measured by means of the standard Dutch version of the European Quality of Life instrument (EQ-5D) [11], a validated general quality of life instrument frequently used, and ADL by means of the Barthel index (BI) [12], the most frequently used and validated instrument for measuring ADL in stroke research.

Secondary outcome measures were: instrumental activities of daily life (measured by means of the Frenchay Activity Index FAI) [13], handicap (Modified Rankin Scale MRS) [14], cognitive functioning (Mini Mental State Examination MMSE, Apraxia Test AT and Star Cancellation Test SCT) [15,16,17], anxiety and depression (Hospital Anxiety and Depression Scale HADS) [18], sickness specific quality of life (Stroke Adapted Sickness Impact Profile 30 SA-SIP30) [19], satisfaction with care (Satisfaction with stroke care Questionnaire SASC-19) [20] and strain on caregivers (Caregivers' Strain Index CSI) [21]. All these secondary measures are reliable and validated for use in stroke research. Oth-

er secondary outcome measures were length of hospital stay (LOS H), length of nursing home stay (LOS NH) and medical complications occurring within 3 months after stroke. The following diagnoses were regarded as medical complications: a new stroke, pneumonia, urinary tract infections, epileptic seizures, fractures, myocardial infarct, atrial fibrillation and heart failure. The data on medical complications were collected from patients' files.

In addition to the primary and secondary outcome measures, we assessed relevant background variables. The following personal characteristics were assessed: age, gender, socio-economic status, co-morbidity, risk factors, stroke location, stroke classification and stroke severity, as measured by the National Institute of Health Stroke Scale (NIHSS) [22]. All background variables were measured within a week after the stroke (baseline).

Patients were assessed by the researchers at baseline, 1 month, 3 months and 6 months after their stroke. Due to the non-randomised design of the study, the researchers weren't blinded to group assignment. An overview of the measures used and moments of assessment is shown in Table 1.

Table 1. Overview of used measures in this study

Data	Time	Subject of assessment
Characteristics		
Age, gender, socio-economic status, risk factors, co-morbidity, stroke classification, stroke location	T0	Comparison at baseline
Length of stay		
Hospital	T0-T3	
Nursing home	T0-T3	
Primary outcome		
EuroQol	T2,T3	Health-related quality of life
Barthel Index	T0,T1,T2,T3	Activities of daily life
Secondary outcome		
SASIP-30	T2,T3	Stroke specific quality of life
FAI	T0,T3	Instrumental activities of daily life
MRS	T0,T1,T2,T3	Level of handicap
MMSE	T0,T3	Screening for cognitive dysfunction
AT	T0,T3	Measuring the degree of apraxia
SCT	T0,T3	Testing for neglect
HADS	T1,T3	Identifies anxiety and depression
CSI	T3	Caregivers strain
SASC-19	After every discharge	Satisfaction with care
Medical complications	T0-T2	

T0= within 1 week after stroke, T1= 1 month after stroke, T2= 3 months after stroke, T3= 6 months after stroke

The Medical Ethical Committee of the University of Maastricht approved the study. All patients gave their informed consent to take part in the study. The study was registered as: Current Controlled Trials ISRCTN58135104. Detailed information on the measurement instruments used is published elsewhere [9].

Sample Size

The total sample size planned was 139 participants per group [9]. This included a 25% dropout rate, which means a remaining sample of 104 patients per group. Based on this number of participants and an independent samples t-test, a standardized effect size (Cohen's d) of 0.4 can be detected with 80% power and a significance level of 0.05. This effect size is classified as small (d = 0.2) to medium (d = 0.5) by Cohen [23] and corresponds to a mean difference of 0.1 on the EQ-5D with a within-group SD of 0.25, which was also found by others [24).

Statistical Analysis

Numerical and categorical variables were presented by mean (SD) and number (%), respectively. Baseline differences between the experimental and control region were examined using an independent samples t-test for numerical variables and a chi-square test for categorical variables. The longitudinal effects of the regions on primary and secondary outcomes were assessed using linear mixed models with an unstructured covariance structure for repeated measures. Region (intervention vs. control), time (time-points at which the outcome is measured, see Table 1), time*region and variables related to the outcome (=all variables mentioned in Table 2) were included as fixed factors. The restricted maximum likelihood estimation method was used. For CSI, SASC-19 and the number of medical complications, which were measured only once, linear regression analysis was used to test the region effect, where the abovementioned variables related to outcome were included as covariates. A p-value ≤ 0.05 was considered statistically significant. All analyses were performed with IBM SPSS for Windows (version 20.0 Armonk. NY:IBM Corp.).

Results

The trial flow chart (Figure 1) shows the flow of patients during the trial. Between May 2009, and July 2011, 1104 stroke patients were identified who were admitted to one of the two hospitals participating in the trial. 146 patients (13%) were excluded from the intervention and 184 (17%) from the usual care group because they were not able to give their consent, did not speak Dutch fluently, had a recurrent stroke or were not living in the stroke care region. Of the remaining 774 patients, 122 (16%) in the intervention and 178 (23%) in the usual care group were not able to give consent within a

week and 115 (15%) in the intervention and 120 (16%) in the usual care group refused to give their consent. Of the 239 patients participating, 1 (0.4%) in the intervention and 3 (1.3%) in the usual care group moved out of the stroke service area and 7 (3%) patients withdrew their consent in the intervention versus 1 (0.4%) in the usual care group. During the study 8 (3%) patients in the intervention group died in comparison with 4 (2%) in the usual care group.

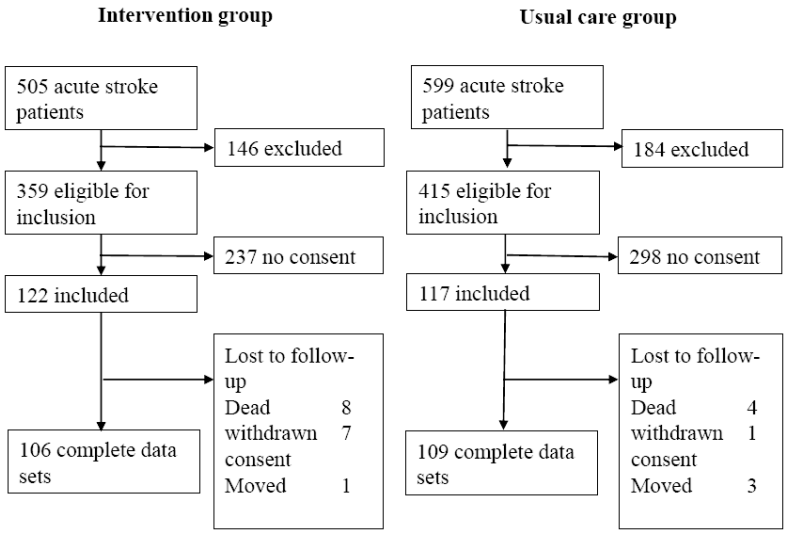

Figure 1. Trial Flow Chart

Baseline characteristics

Table 2 summarizes the baseline characteristics, looking at the demographic and clinical features of both groups. Participants in the intervention group were significantly older (p= .049) more often had a lower education (p= 0.02), a lower BI (p= .020), or a higher SCT (p= .039).

The NIHSS was not systematically registered in the participating hospitals, resulting in insufficient NIHSS data for analysis.

Table 2. Baseline characteristics of patients

Characteristic	Intervention Group (N=122)	Control Group (N=117)	P Value
Age, mean (SD)	74.1(13.1)	70.8(12.8)	.049
Gender, number (%) male/female	66/56(54.1/45.9)	75/42(64.1/35.9)	.116
Education (%)			
Low	57(47.5)	35(30.4)	.021
Middle	43 (35.8)	50(43.5)	
High	20 (16.7)	30(26.1)	
Living alone (%)			
Yes/No	41/76(35.0/65.0)	40/75(34.8/65.2)	.967
Stroke classification (%)			
LACI	43(35.8)	47(44.8)	.333
TACI	16(13.3)	8(7.6)	
PACI	29(24.2)	22(21.0)	
POCI	21(17.5)	14(13.3)	
Haemorrhage	11(9.2)	14(13.3)	
Stroke location (%)			
Left	52(42.6)	45(39.5)	.886
Right	63(51.6)	62(54.4)	
Other	7(5.7)	7(6.1)	
Risk factors (%)			
Yes/No	98/23(81.0/19.0)	104/13(88.9/11.1)	.089
Comorbidity (%)			
Yes/No	79/42(65.3/34.7)	64/53(54.7/45.3)	.095
Thrombolysis (%)			
Yes/No	16/106(13.1/86.9)	23/89(20.5/79.5)	.088
Barthel Index, mean (SD)	13.9(6.0)	15.7((5.7)	.020
Frenchay Activities Index, mean (SD)	21.5(9.1)	23.4(7.9)	.081
Modified Rankin Scale, mean (SD)	2.4(1.5)	2.7(1.3)	.074
Mini Mental State Examination, mean (SD)	24.1(5.9)	25.2(5.8)	.126
Apraxia Test, mean (SD)	84.7(15.5)	87.0(10.5)	.205
Star Cancellation Test, mean (SD)	49.1(9.2)	45.3(14.7)	.039

Stroke classification; LACI: Lacunar Circulation Syndrome, TACI: Total Anterior Circulation Syndrome, PACI: Partial Anterior Circulation Syndrome, POCI: Posterior Circulation Syndrome.
Barthel Index (range 0-20), Frenchay Activities Index (range 0-45), Modified Rankin Scale (range 0-5), Mini Mental State Examination (range 0-30), Apraxia Test (range 0-90), Star Cancellation Test (range 0-54).
For MRS the lower the score the better the performance.
For BI, FAI, MMSE, AT, SCT the higher the score the better the performance.

Table 3. Estimated means (SE) or number (%) of outcome at baseline, 1, 3 and 6 months adjusted for baseline characteristics

	Baseline		1 month		3 months		6 months		P Value
	I	C	I	C	I	C	I	C	
Euroqol index					0.75(0.04)	0.77(0.04)	0.80(0.04)	0.79(0.04)	.414
Euroqol vas					70.5(2.72)	74.6(2.66)	72.8(2.46)	76.7(2.42)	.938
BI	15.2(0.71)	16.2(0.68)	16.3(0.66)	17.7(0.63)	17.0(0.60)	18.4(0.58)	17.2(0.63)	18.6(0.60)	.737
MRS	1.7(0.13)	2.4(0.13)	1.4(0.15)	1(0.14)	1.3(0.14)	2.0(0.14)	1.3(0.16)	1.9(0.16)	.826
SA-SIP30					8.0(0.90)	7.3(0.82)	8.2(0.94)	6.9(0.86)	.479
FAI	25.6(1.34)	25.3(1.22)					18.1(1.47)	20.4(1.33)	.040
MMSE	25.4(0.73)	25.0(0.67)					26.0(0.77)	26.5(0.69)	.185
Apraxia Test	86.0(1.65)	87.6(1.54)					88.1(1.56)	88.7(1.43)	.416
SCT	50.4(1.48)	46.5(1.39)					51.9(1.20)	50.6(1.08)	.071
HADS A			4.8(0.86)	4.4(0.84)			4.2(0.84)	4.3(0.75)	.508
HADS D			6.5(0.78)	5.0(0.70)			6.4(0.78)	4.3(0.69)	.434
CSI							5.5(0.77)	4.5(0.69)	.192
LOS H (days)							9.5(1.06)	9.1(0.95)	.717
LOS NH (days)							64.8(16.0)	73.1(16.3)	.635
SASC-19									
Hospital							17.1(0.83)	17.6(0.76)	.531
Nursing Home							15.4(0.77)	17.1(1.11)	.149
Rehab.Center							17.1(1.38	17.2(1.38)	.921
Home							18.6(1.26)	17.2(1.09)	.210
Discharge (%)									
Nursing Home	81(66)	29(25)							
Rehab.Center	13(11)	8(7)							
Home	29(23)	80(68)							
Medical Complications <3 months (%)							24(20.2)	35(30.4)	.071
Hospital Readmittance <6 months (%)							12/121(9.9)	10/115(8.7)	.747
Death < 6 months (%)							8(6.6)	4(3.5)	.287

I= intervention group C= usual care group; SASIP-30 (range 0-30), Barthel Index (range 0-20), Frenchay Activities Index (range 0-45), Modified Rankin Scale (range 0-5), Mini Mental State Examination (range 0-30), Apraxia Test (range 0-90), Star Cancellation Test (range 0-54), Hospital Anxiety and Depression Scale (range 0-21) Caregiver Strain Index (range 0-13)
For SASIP,HADS,MRS,CSI the lower the score the better the performance.
For BI, FAI, MMSE, AT, SCT the higher the score the better the performance
*estimated means = mean values for intervention and control group at a certain time point after correction for all variables included in the model. These are obtained from linear mixed model analysis.

Table 3 shows the estimated means (SE) or numbers (%) for primary and secondary outcomes, measured at baseline, 1, 3 and 6 months after stroke. As expected there were no significant differences between the intervention and usual care group in EQ-5D, SA-SIP30, BI, MMSE, AT, HADS, SASC, and CSI scores. Furthermore, there were no significant differences in length of nursing home stay, medical complications, hospital re-admittance or deaths between both groups. Unexpectedly, we also found no significant differences in length of hospital stay between both groups and a significantly lower FAI score at 6 months in the intervention group (mean 18.1, SE 1.46) in comparison with the control group (mean 20.4, SE 1.32,p = .040). As expected, significantly more stroke patients were assessed in a nursing home in the intervention group (66%) in comparison with the usual care group (25%). There were also significant differences in the number of patients who were discharged home, directly after their hospital stay, (23% in intervention group versus 68% in control group). Admission to a rehabilitation centre was not significantly different between both groups (11% in intervention group versus 7% in the control group).

Discussion

This study, in accordance with earlier studies [8], showed no clinically relevant differences in functional outcomes, quality of life or satisfaction with stroke care between two types of care delivery for acute stroke patients. Neither the EQ-5D index nor the EQ-5D visual analogue scale showed significant differences between the two groups over time. It can be concluded that the generic quality of life experienced by both groups is similar. A more stroke-specific quality of life instrument, the SASIP-30 also failed to show significant differences between the two groups.

Furthermore, the aim of the intervention, namely early discharge of patients from hospital to a nursing home within five days after stroke, has not been achieved. We found that the mean duration of hospital stay was comparable in both groups and the length of stay in the nursing home in the intervention group was on average 8.3 days shorter. Although there were no differences in the length of hospital stay between both groups, in the intervention group significantly more patients were admitted to the nursing home than in the control group (66% in comparison with 25%), where significantly more stroke patients were discharged home after their initial hospital stay (68% compared to 24%).

Accordingly, one can conclude that the assessment in the nursing home was implemented considerably well, although with a delay of about 5 hospital days. A previous study on the effects of early hospital discharge combined with assessment and rehabilitation planning in a nursing home was done shortly after implementation of the current intervention in the Maastricht Heuvelland stroke service [5]. This study, in the same hospital and same stroke service, demonstrated a decrease in hospital stay from 12 to

7.3 days. Why this initial decrease in hospital stay was not maintained is unclear, but we will reflect on some possible causes later in the discussion.

The small but significantly better FAI score at 6 months, in the usual care group, could be explained by the fact that in this group more patients were discharged home directly after their hospital stay. Being at home might affect the FAI in a positive way, as patients are forced to employ the skills measured by the FAI more often than are institutionalized patients. This effect has been described by other authors [25]. It is also possible that this finding does not have clinical meaning, as a difference of less than 4 points on the FAI is regarded as clinically irrelevant [26], even though statistically significant.

Internationally, the mean duration of hospital stay after stroke (with early supported discharge) varies between 9.8 and 41.9 days [6]. In 2008 in the Netherlands, the mean duration of hospital stay after stroke was 10.5 days [27]. In this light, the intervention and usual care group perform somewhat better with 9.5 and 9.1 days of hospital stay respectively.

A possible explanation for the increase in duration of hospital stay found in our study in comparison with the previous study by Vos is clinical variation in stroke severity. The severity of stroke, as scored by the mean BI in our study, has been found to be a predictor for length of hospital stay [28]. In the earlier study stroke severity was not measured. It can well be that during the limited inclusion period of this study, only 4 months, patients with less severe strokes were included, resulting in shorter hospital stays. In our study we found that the BI of stroke patients admitted to the hospital in the intervention group was significantly worse than that of stroke patients admitted to the hospital in the usual care group. However, when corrected for baseline differences, no significant differences were found.

Another explanation for not maintaining early discharge in the intervention region could be changes in hospital personnel; this could have led to unfamiliarity with the early discharge procedures and subsequently longer hospital stays for stroke patients. During the research period the stroke care coordinator in the intervention region resigned. This could also have contributed to not maintaining the initial results in reducing length of hospital stay. Furthermore, the early enthusiasm of the team right after implementation of the new structure may have eroded during the following years.

After controlling for baseline scores, the length of nursing home stay in the intervention group was 64.8 days compared to 73.1 days in the control group. The average nursing home stay for stroke rehabilitation in the Netherlands is 69 days [29]. So again, both groups perform more or less in conformity with the national level. Although there was no significant difference between both groups, on average stroke patients in the intervention group were discharged 8.3 days earlier from the nursing home than were patients in the usual care group and 4.2 days earlier than average stroke patients in the Netherlands.

Study strengths and limitations

A strength of this study is the uniqueness of the care model investigated, with assessment and rehabilitation planning within a nursing home. Another strength of this study is the systemic and holistic manner in which stroke outcomes were measured, with validated instruments.

A limitation of this study is the non-randomised design. The study was carried out after the new care model had already been implemented. It was not possible to organize a large RCT, with many participating regions that would consent to expose themselves, or not, to early discharge from hospital and nursing home assessment. Although both regions were selected because of their comparability, surprisingly we found several baseline differences between the research groups. This might have influenced the results in the intervention group in a negative way, because older age and greater disability both correlate with lesser functional outcomes. The differences between the regions are most likely caused by the more advanced age of the population in the Maastricht area [30].

Conclusion

As expected there were no clinically relevant differences found in quality of life, satisfaction with care and functional outcomes between the intervention and the control group. Although the new care model failed to implement early discharge, more stroke patients in the intervention group were assessed by a multidisciplinary team in a nursing home in comparison with the usual care group, where more patients were discharged home after their initial hospital stay. Which stroke care model is more cost efficient can be answered only by a cost-effectiveness analysis and cost utility analysis. Both are also part of this study and will be published separately.

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Chapter 5

Economic evaluation of a non-randomised comparative study on an innovative model for stroke care with rehabilitation assessment in a nursing home

Ron WH Heijnen, Silvia MAA Evers, Trudy DEM van der Weijden, Martien Limburg, Bjorn Winkens, Jos MGA Schols

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Abstract

Background: Stroke services, stroke units and early discharge services have been found to be cost-effective. Further improvements of the organisation of these services, in terms of shorter hospital stay, improved diagnostics and early rehabilitation start, may even be more cost-effective. We conducted a study to assess the cost-utility and cost-effectiveness of a new stroke care model aiming at the early discharge of stroke patients from hospital to a nursing home for systematic assessment and planning rehabilitation.

Methods: The economic evaluation was embedded in a non-randomised comparative trial for which 239 acute stroke patients were recruited from two stroke services in the regions of Maastricht and Eindhoven. The intervention, a new stroke care model, consisted of hospital discharge within 5 days post-stroke to a nursing home, followed by systematic multidisciplinary assessment in a specialised nursing home assessment unit to determine the optimal rehabilitation track. Usual care consisted of an average 10 days' hospital care, followed by a less extensive assessment. Self-reported costs and quality of life were assessed during a 6-month follow-up period. Quality of life was measured with a disease specific (SASIP-30) and a generic (EQ-5D-3L) quality of life instrument. The economic evaluation was conducted from a societal perspective. Uncertainty was accounted for by bootstrapping and sensitivity analyses.

Results : Overall costs were higher in the intervention group (I: mean=22009, 95%CI: 21720, 22298; C: mean=19769, 95%CI: 19430, 20108). Significant differences were found between the groups in some baseline characteristics, age, educational level, activities of daily living and visual scores. After correcting for these differences, the cost-utility analyses, using generic quality of life as the outcome measure, showed that the new model for stroke care was the more efficient, at a Willingness to Pay threshold of € 50,000 per Quality Adjusted Life Year (QALY). Using disease-specific quality of life as an outcome measure, the cost-effectiveness analyses showed that the new stroke care model was more effective and more expensive in comparison with care as usual.

Conclusion: To our knowledge this is the first study to determine the cost-utility and cost-effectiveness of a stroke service aimed at early hospital discharge with subsequent assessment and rehabilitation planning in a nursing home. With a willingness to pay 50,000 euros for a Quality Adjusted life Year gained, the new stroke care model proved, with a probability of 76% to be the more cost effective. However, based on the current study, we cannot give a definite answer whether the new stroke model is a good investment.

Background

Strokes have a profound effect on a person's life and also represent a large economic burden to society [1]. In the Netherlands, stroke is among the top five diseases in terms of costs, accounting for 2.3 billion euros a year, representing 2.5% of annual total healthcare costs [2]. It is estimated that in the coming years, the prevalence of stroke will rise due to the ageing population and the better survival of cardiovascular patients [3]. Changes in healthcare delivery, driven by the need to reduce costs, have resulted in both a decrease in the length of hospital stay and the number of acute care beds in hospitals [4]. Therefore, managing the growing number of strokes will demand creative efficient solutions that won't affect stroke outcomes in a negative way.

To reduce the length of hospital stay and costs, the effects of various forms of integrated care delivery, such as early supported discharge and the chain supply of stroke services have been studied internationally. They all seem to reduce costs, but a variety of costing perspectives were used, leading to the exclusion of some costs from a societal perspective [5]. In all studies, the assessment of stroke patients to determine their rehabilitation track took place in hospital, which could have lengthened the duration of the hospital stay. We evaluated a new stroke care model, consisted of hospital discharge within 5 days to a nursing home, followed by a systematic multidisciplinary assessment in a specialised nursing home assessment unit to determine the optimal rehabilitation track. The development and implementation of this care model are described elsewhere [6,7]. Early discharge from a hospital to a nursing home for assessment of stroke-induced disabilities and for rehabilitation planning might be more cost-efficient from a societal perspective for the Dutch setting, where a considerable part of the post-stroke rehabilitation of older patients already takes place in nursing homes [8]. As further improvement could be gained from early discharge from hospital in combination with rehabilitation assessment in other care facilities, such as a nursing homes, makes it interesting for decision makers as well as researchers. Although it is known that stroke units and early discharge services are cost-effective [9,10], this study explores further improvement by combining early discharge from hospital with a rehabilitation assessment in a nursing home.

The primary goal of the new stroke care model was to achieve cost reduction and similar or even better quality of life and functional outcomes. Our hypothesis was that the new stroke care model is more cost-efficient than care as usual. In order to study this, we performed a non-randomised comparative study in which the innovative care model provided by the stroke service Maastricht Heuvelland, the intervention region, was compared with "care as usual" provided by the stroke service in the area of Eindhoven.

The aim of this paper is to estimate the cost-utility and cost-effectiveness of the new stroke care model, from a societal perspective, in which all relevant costs and effects are taken into account.

Methods

Design

This trial-based economic evaluation compares the costs and effects of the new stroke care model with care as usual from a societal perspective, meaning that all relevant costs and effects are taken into account. Trial based means that the economic evaluation is piggy-backed on a non-randomised trial and not based on modelling. Relevant costs were defined by looking at relevant categories for stroke patients, big tickets, and expected differences between intervention and control.

The economic evaluations consist of the following five usual steps [11]. First, a societal perspective is chosen within which relevant costs are identified, conform the Dutch guideline for economic evaluation [12]. Second, costs and effects are assessed prospectively with cost and outcome questionnaires. Third, costs are evaluated in monetary currency with the help of manuals for cost analysis in healthcare research [13]. Effects are expressed as changes in quality of life scale (SASIP) and Quality Adjusted Life Years (QALY) gained or lost. Fourth, an incremental cost-effectiveness ratio is calculated and finally, bootstrap analyses and sensitivity analyses can be conducted to deal with sampling uncertainty and uncertainties in assumptions made.

The present economic evaluation study was embedded in a non-randomised comparative study that tested the effectiveness of a new stroke care model. This trial-based economic evaluation study was conducted among acute stroke patient from May 2009, till January 2012.

Study Population

The study population consisted of consecutive stroke patients admitted to hospital in both research regions. The diagnosis of stroke was made by a neurologist based on the patient's history, a physical examination and neuro-imaging.

Patients were eligible to participate if they met the following inclusion criteria: over 18 years of age and fluent in Dutch. Exclusion criteria were: life expectancy of less than a few days, a previous diagnosis of dementia, hospital discharge to home within a few days and occurrence of complications requiring prolonged hospital care. A patient with a recurrent stroke could be included only once. Detailed information about the research protocol is published elsewhere [6].

The Medical Ethics Committee of Maastricht University/Maastricht University Medical Centre approved the study. All patients gave their informed consent for participating in the study. The study was registered as: Current Controlled Trails ISRCTN58135104.

Intervention

The intervention involved a critical care pathway for stroke patients admitted to the Maastricht University Medical Centre. In this care pathway, every stroke patient is admitted directly to the hospital stroke unit. In the emergency ward, acute diagnostic tests are performed. In case of a confirmed stroke, the patient is admitted to the stroke unit of the hospital, where further diagnosis and treatments, including thrombolysis if indicated, are performed.

Subsequently, the care model consists of a strict discharge regime from the neurology ward of the Maastricht University Medical Centre. All necessary tests and treatment in the hospital are planned to take place within 5 days after admission. Thereafter, basically, all stroke patients, regardless of age or stroke severity, are discharged to the stroke ward in the nursing home, where a comprehensive assessment takes place.

A skilled elderly care physician examines each patient immediately on arrival in the nursing home and initiates the assessment program. In this program, a multidisciplinary team consisting of a physiotherapist, occupational therapist, psychologist, speech therapist and trained nurses, examines the patient by performing a structured assessment protocol. Following this assessment, the team meets within five days after the patient's admission to the nursing home stroke ward to make recommendations for a rehabilitation program specifically tailored to the patient. After this multidisciplinary meeting, the patient and his family are informed about the proposed rehabilitation track, and, if they approve, this track is started.

There are three options for rehabilitation after the assessment in the nursing home.

1. Rehabilitation at home with home care and outpatient treatment provided by therapists from primary healthcare or day care rehabilitation in a hospital or nursing home
2. Inpatient rehabilitation in a specific nursing home rehabilitation ward
3. Inpatient rehabilitation in a specialised clinical rehabilitation centre

Usual Care Group

In Stroke Service Eindhoven, stroke patients are admitted to the stroke unit of the Catharina hospital in Eindhoven, where diagnostic tests, treatment and observation take place. During the hospital stay an assessment is performed in order to determine the best suitable rehabilitation facility for the stable patient. A physiotherapist, an occupational therapist and trained nurses carry out the assessment; if necessary they are supported by a psychologist or a speech therapist.

On the basis of admission and discharge criteria formulated by various care providers the patient can be discharged to his/her home, to a clinical rehabilitation centre or to one of four nursing homes participating in the stroke service. During the study peri-

od, the mean duration of the hospital stay in Eindhoven was 10 days [14]. Consequently, the main differences in care arrangements between the experimental and the control region are the early hospital discharge and the structured multidisciplinary assessment in the nursing home in the intervention region.

Measurements

Identification, measurement, and valuation of costs

As the study was performed from a societal point of view, all costs concerning intervention, health care and patients' costs were relevant. Developmental costs of the intervention were excluded because these costs are sunk costs, costs that have been spent before the intervention was implemented. Intervention costs themselves were registered in a cost questionnaire.

Healthcare costs involved: length of stay (hospital, nursing home or rehabilitation centre), GP visits, visits to hospital outpatient departments, use of medication, hospital readmissions and paramedical care. Patients' costs consisted of costs for traveling, loss of wages, home care, personal alarm, meals, assistive devices, and home adaptations.

A cost questionnaire was administered at 3 and 6 months, the same time points as the outcome measurements took place. The cost questionnaire was designed to collect all the above information on costs by asking patients what type of care they had received and how often.

The healthcare and patient costs were measured on the individual patient level, based on individual health care utilization and on unit costs for health resources provided by the college of health insurers [13]. Costs of transport were calculated as the mean distance per destination multiplied by standard cost prices. Costs of medication were calculated using the prices based on Daily Defined Dosage (DDD) taken from the Dutch Care Institute [15], indicating the mean medication usage per adult per day. Productivity costs were calculated by means of the friction costs method, based on a mean added value of the Dutch working population. The costs of home care, personal alarm, meals, the use of assistive devices and home adaptations were based on common market prices as published by the providers.

The price year chosen was 2009, the first year of patient inclusion, and the currency was the Euro. Since the time horizon of the trial was less than 6 months, it was not necessary to discount costs and health benefits.

Identification, measurement, and the valuation of effects

Within the cost-utility analysis (CUA), outcomes were measured by means of the standard Dutch version of the EuroQol (EQ-5D-3L) [16], which is the measure for quality of

life both nationally and internationally [17]. This is a self-administered questionnaire, which was completed together with the cost questionnaire at 3 months and 6 months. Both generic quality of life and utilities were derived by means of the EQ-5D-3L. The EQ-5D-3L was chosen because it is a widely used quality of life instrument. The EQ-5D-3L contains 5 dimensions of health-related quality of life: mobility, self-care, daily activities, pain/discomfort and anxiety/depression. Each dimension can be rated on three levels: no problems, some problems and major problems. The 5 dimensions can be added to comprise an overall health state. This health state was translated into a number, a utility. Utility values can be calculated for these health states, using preferences elicited from a general population, the so-called Dolan algorithm [18]. The utility values derived from the Dolan algorithm were used to compute (QALYs). The Dolan algorithm has been established using a general population from the UK, and is elaborated international standard. A Dutch algorithm is also available, and this was used in the sensitivity analysis [19]. The utilities at the two time points were used to compute a (QALY) score by means of the area under the curve method. The primary outcome measure for the cost-utility analysis were (QALYs), based on the EuroQol utility scores.

The primary outcome measure used for the cost-effectiveness analysis (CEA) was stroke-specific quality of life measured with the Stroke Adapted Sickness Impact Profile (SASIP 30) at 3 and 6 months follow-up. This is a validated stroke-specific quality of life scale [20], containing 30 items. Each item takes the form of a statement describing changes in behaviour that reflect the impact of illness on some aspect of daily life. Patients are asked to mark items most descriptive of themselves on a given day. All response scales are dichotomous "yes" or "no". The scores range from 0 to 30. The higher the score, the less the quality of life after stroke.

Analysis

The analyses were conducted using the intention to treat principle. Missing EQ-5D-3L and SASIP 30 scores were replaced by the imputation of mean group scores, if all measurements of a patient were missing or by the imputation of a patient's previous or next measurement if only one measurement was missing. Patients with all data missing, on both costs and effect measurements, were not included in the analyses. In a non-randomised comparative study, it is necessary to account for differences between the groups. To determine if selective dropout had occurred, a comparison was made between those lost to follow-up and those who remained in the study. Independent samples t-tests for numerical variables and chi-square tests for categorical variables were conducted to compare treatment with the control group and to assess selective dropout. A p-value ≤ 0.05 was considered statistically significant.

Cost-utility and cost-effectiveness analyses

Incremental costs and effects were calculated for the intervention and care as usual group. Then an incremental cost-effectiveness ratio (ICER) was calculated to compare costs and effects between pairs of the study group. The calculation was done using the formula: ICER=(Ci-Cc)/(Ei-Ec). In this formula, Ci stands for costs in the intervention group, Cc for costs in the control group, Ei for effect in the intervention, and Ec for effect in the control group.

The cost-effectiveness of an intervention can be compared to care as usual graphically, with the help of a cost-effectiveness plane (Fig. 1a-6a) in which a cost dimension (y-axis) and an effect dimension (x-axis) are represented. A cost outcome pair of the usual care is placed at the intersection point of the cost-effects axes. Changes in costs and effects between care as usual and the experiment can then be plotted in the cost-effectiveness plane. The cost-effectiveness plane can be divided into four quadrants (northwest, southeast, southwest and northeast). The northwest quadrant represents lesser effects and higher costs for the intervention group, while the southeast quadrant represents better effects and lower costs. In the northeast and south western quadrants, it depends on the cost-effectiveness threshold or willingness to pay per QALY whether an intervention is cost-effective compared to care as usual.

Uncertainty analyses

To correct for sample uncertainty, bootstrap analyses were applied [21]. A cost-effectiveness acceptability curve was estimated using a non-parametric bootstrap method on the basis of 5000 replications to address the uncertainty surrounding the ICERs. The cost-effectiveness acceptability curve indicates the probability that the intervention will be cost-effective relative to care as usual, given a particular level that the decision makers are willing to pay for additional effect. Whether the health effects are worth the money depends on our willingness to pay for a certain effect, this is the so-called cost-effectiveness threshold (CE threshold). Different countries use different CE thresholds. We used a CE threshold of 50,000 euros per QALY, based on the government report on cost-effectiveness [22]. Bootstrap analyses were conducted by Microsoft Office Excel 2003. All other analyses were conducted using IBM SPSS Statistics for Windows, version 19.0.

The primary analysis, or baseline scenario, compared the intervention and care as usual group with the imputation of missing outcome values as discussed before and correction for differences at baseline. A sensitivity analysis was conducted using two scenarios. In the first sensitivity analysis, we assumed that the intervention would lead to an early discharge within 5 days after hospital admission as intended in the original design of the intervention [23]. Therefore, we tested whether successful implementa-

tion of early hospital discharge (intervention) would have led to a change in results (scenario 1). In several countries economic evaluations are performed from a healthcare perspective instead of societal perspective, in the second scenario we therefore performed an analysis from a healthcare perspective (scenario 2).

Results

Of the 774 acute stroke patients eligible for inclusion, 239 gave their informed consent. About half of these patients (n=122) participated in the intervention group, while 117 patients were included in the control group. In the intervention group, 8 patients (7%) were lost during follow-up versus 4 (3%) in the control group. Participants lost during follow-up did not differ significantly with regard to demographic variables from those who remained in the study after 6 months. Costs were missing for 12 patients (5,0%), EQ-5D-3L scores for 12 patients (5,0%) and SASIP 30 scores for 15 (6,3%) patients. After missing data were imputed, total data were available for 227 (94.9%) of the participants.

Table 1 summarizes baseline characteristics looking at the demographic and clinical features of both groups. Participants in the intervention group were significantly older (p= .049) and more often had a lower education (p= .021), a lower (more dependent in activities of daily living) Barthel Index (p= .020), and a better (less visual shortages) Star Cancellation Test (p= .039).

Table 1. Baseline characteristics of patients

Characteristic	Intervention Group (N=122)	Control Group (N=117)	P Value
Age, mean (SD)	74.1(13.1)	70.8(12.8)	.049
Gender, number (%) Male/female	66/56(54.1/45.9)	75/42(64.1/35.9)	.116
Education (%)			
Low	57(47.5)	35(30.4)	.021
Middle	43 (35.8)	50(43.5)	
High	20 (16.7)	30(26.1)	
Living alone (%)			
Yes/No	41/76(35.0/65.0)	40/75(34.8/65.2)	.967
Stroke classification (%)			
LACI	43(35.8)	47(44.8)	.333
TACI	16(13.3)	8(7.6)	
PACI	29(24.2)	22(21.0)	
POCI	21(17.5)	14(13.3)	
Haemorrhage	11(9.2)	14(13.3)	
Stroke location (%)			
Left	52(42.6)	45(39.5)	.886
Right	63(51.6)	62(54.4)	
Other	7(5.7)	7(6.1)	
Risk factors (%) Yes/No	98/23(81.0/19.0)	104/13(88.9/11.1)	.089
Comorbidity (%) Yes/No	79/42(65.3/34.7)	64/53(54.7/45.3)	.095
Thrombolysis (%) Yes/No	16/106(13.1/86.9)	23/89(20.5/79.5)	.088
Barthel Index, mean (SD)	13.9(6.0)	15.7 (5.7)	.020
Frenchay Activities Index, mean (SD)	21.5(9.1)	23.4(7.9)	.081
Modified Ranking Scale, mean (SD)	2.4(1.5)	2.7(1.3)	.074
Mini Mental State Examination, mean (SD)	24.1(5.9)	25.2(5.8)	.126
Apraxia Test, mean (SD)	84.7(15.5)	87.0(10.5)	.205
Star Cancellation Test, mean (SD)	49.1(9.2)	45.3(14.7)	.039

Stroke classification; LACI: Lacunar Circulation Syndrome, TACI: Total Anterior Circulation Syndrome, PACI: Partial Anterior Circulation Syndrome, POCI: Posterior Circulation Syndrome.

Cost and Effects

Overall costs were higher in the intervention group. The cost difference was caused by higher healthcare related costs in the intervention group, especially nursing home costs

and costs for day care made up the difference (Table 2). Patients' costs were lower in the intervention group. The differences in patients' costs were mainly caused by more costs made due to loss of wages, in the control group. Regarding effects on quality of life, or activities of daily life assessed at 6 months follow-up there were no significant differences between the intervention and control group (Table 3).

Table 2. Mean costs per participant during 6 months in the intervention and control group

	Costs per group (€) Mean (SD)[a]		Difference in Mean	95% CI[a]
	Intervention	Control		
Health care related costs				
Hospital	4406(196)	4643(292)	-237	-940 to 439
Nursing Home	8572(1206)	6436(1203)	2136	-192 to 6420
Rehab. Center	2592(827)	2208(910)	385	-2097 to 2765
Transport	473(21)	394(16)	79	30 to 131
General practitioner	44(7)	59(7)	-15	-33 to 4
Medical specialist	142(15)	209(15)	-66	-107 to -29
Hospital readmission	453(163)	822(318)	-369	-1105 to 245
Medication	214(36)	225(27)	-11	-93 to 83
Paramedical care	372(66)	405(63)	-33	-204 to 139
Day care	2852(557)	1701(355)	1150	-105 to 2415
Total	**20645(1343)**	**17402(1572)**	**3244**	**-481 to 7337**
Patients costs				
Home care	693(149)	728(159)	-34	-465 to 380
Assistive devices	355(62)	345(83)	10	-205 to 217
Home adaptations	178(83)	450(195)	-272	-705 to 114
Traveling	14(1)	18(2)	-3	-8 to 6
Loss of wages	74(71)	776(404)	-702	-2017 to -460
Total	**1323(317)**	**2316(245)**	**-993**	**-1523 to -144**
Total costs	**22009(1572)**	**19769(1841)**	**2241**	**-2382 to 7010**

[a]Based on 1000 bootstrap replications.

Table 3. Mean effect on EQ-5D-3L, ADL and SASIP after 6 months in the intervention and control group

Effects	Intervention	Control	P
EQ-5D-3L[a], Estimated means (95%CI)	0.80 (0.72, 0.88)	0.79 (0.71, 0.86)	.414
Barthel[b], Estimated means (95%CI)	17.2 (16.0, 18.4)	18.6 (17.4, 19.8)	.737
SASIP[c], Estimated means (95%CI)	8.2 (6.4, 10.0)	6.9 (5.2, 8.6)	.479

[a] Based on the Dutch algorithm for the EQ-5D-3L scores

[b] Barthel index (range 0-20) the higher the score the better the performance

[c] Sasip-30 (range 0-30) the lower the score the better the performance

Cost-utility analyses

Baseline scenario

The cost-utility analysis shows a 23% probability that the intervention is less costly and at the same time more effective than care as usual and a 0% probability that the intervention is more costly and less effective than care as usual. In between the asymptotes, the acceptability curve intersects the y-axis at 23%, and with increasing threshold it increases to 91%, which means that there is a 23% probability that the stroke service in Maastricht was cost-saving and a 91% probability that it was more effective. With a willingness to pay 50,000 euros per QALY gained, the new stroke care model would probably (i.e. 76%) be the most efficient stroke service (as shown in figure 1a and 1b).

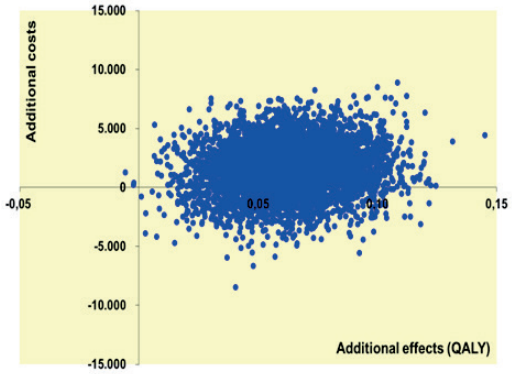

Figure 1a.

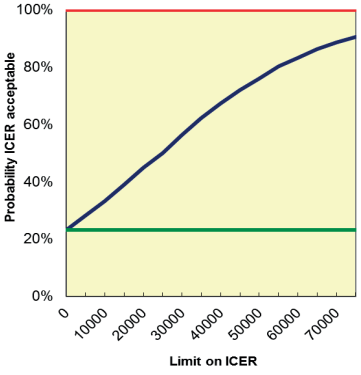

Figure 1b.

As figure 1a shows 91% of the data points have a positive X-axis, representing more effect and 23% of the data points have a positive X-axis and a negative Y-axis which represents more effect and lower costs. Furthermore, 76% of the data points have both a positive X and Y-axis which indicates that the effects are better but costs are also higher.

Scenario 1

If in the sensitivity analyses it was assumed that hospital discharge would have taken place within 5 days after admission, the cost-utility analysis show that the stroke service Maastricht is even more cost-saving and more effective than the stroke service Eindhoven. With a willingness to pay 50,000 euros per QALY gained, the new stroke care model would probably (i.e. 97%) be the more efficient stroke service (as shown in figure 1c and 1d).

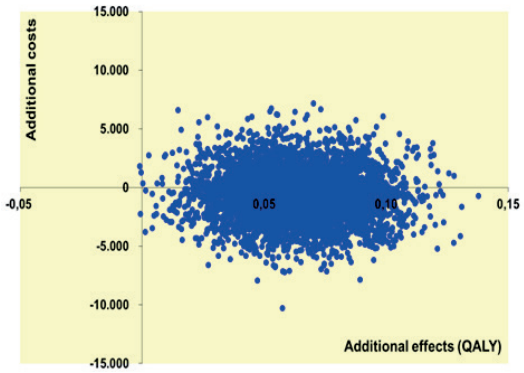

Figure 1c.

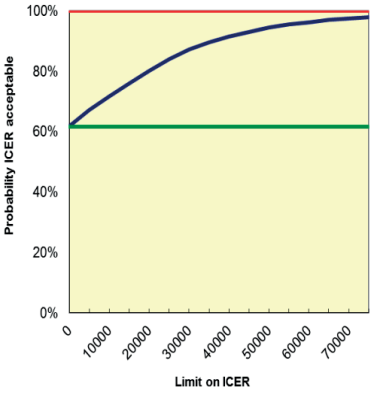

Figure 1d.

Scenario 2

Assuming the healthcare only point of view, the cost-utility analysis shows that the stroke service Maastricht is still the more effective, but also the more costly stroke service. With a willingness to pay 50,000 euros per QALY gained, the new stroke care model would probably be equally efficient (i.e. 66%) to the stroke service Eindhoven (as shown in figure 1 e and 1f).

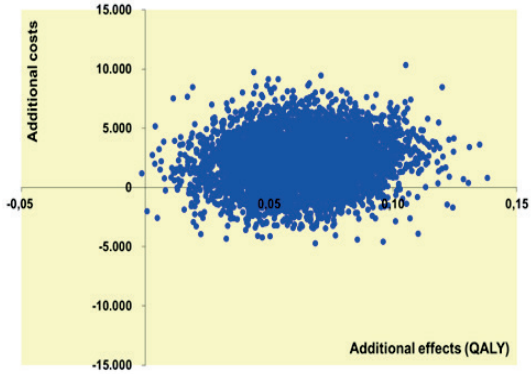

Figure 1e.

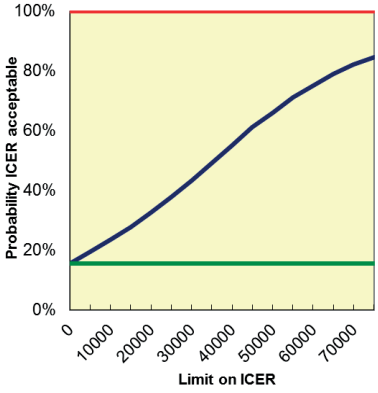

Figure 1f.

Cost-effectiveness analyses

Baseline scenario

The cost-effectiveness analysis shows a 22% probability that the intervention is less costly and at the same time more effective than care as usual and a 0% probability that it is more costly and at the same time less effective. In between the asymptotes, the acceptability curve intersects the y-axis at 22% and with increasing thresholds it increases to 100%, which means that there is a 22% probability that the intervention is cost saving and a 100% probability that it is more effective (as shown in figure 2a and 2b).

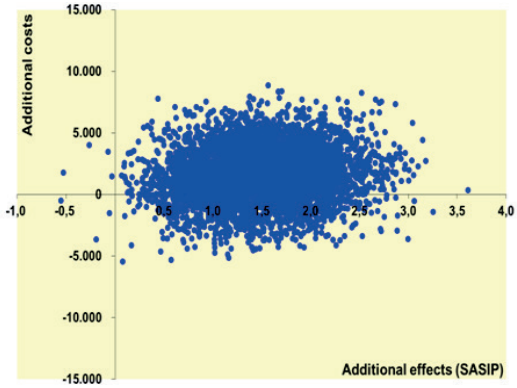

Figure 2a.

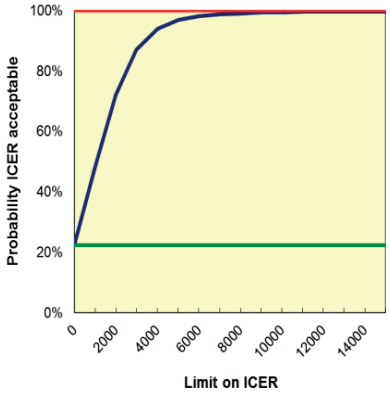

Figure 2b

Scenario 1

Assuming that early hospital discharge (after 5 days) had been achieved, the cost-effectiveness analysis shows that for the new stroke care model the costs were the same and the effects were better compared to the stroke service Eindhoven (as shown in figure 2c and 2d).

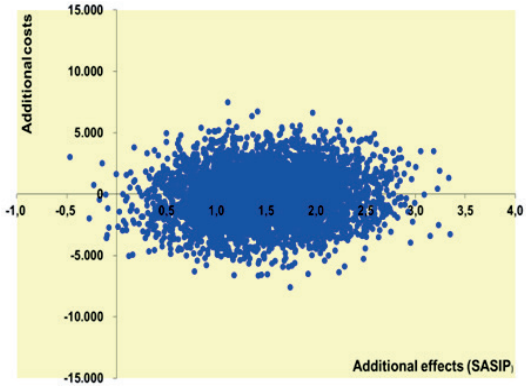

Figure 2c.

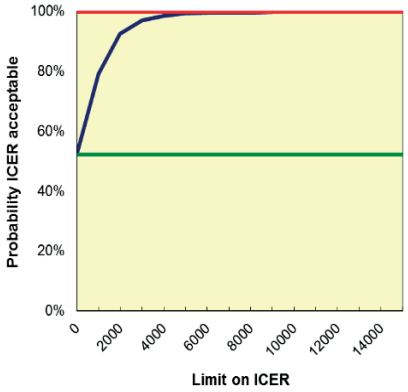

Figure 2d.

Scenario 2

Assuming the health care only perspective, the cost-effectiveness analysis shows that the new stroke care model is more costly and more effective in comparison with the stroke service Eindhoven (as shown in figure 2e and 2f).

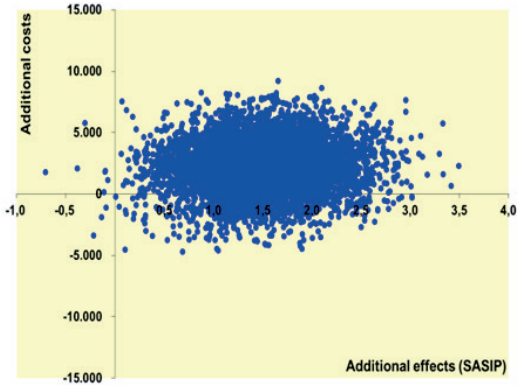

Figure 2e.

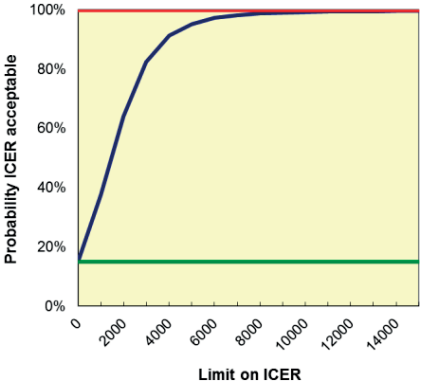

Figure 2f.

Discussion

As far as we know, this is the first study to determine the cost-utility and cost-effectiveness of a stroke service which combines early hospital discharge to a nursing home with assessment and rehabilitation planning there.

With a willingness to pay 50,000 euros for a Quality Adjusted life Year gained, the new stroke care model proved, with a probability of 76%, to be the most cost effective. The overall results show that the new stroke care model has a better utility and effec-

tiveness but is also more costly. If the intervention had succeeded in early hospital discharge, then the new stroke care model would have been the superior treatment. From the standpoint of healthcare perspective costs alone, without achieving early discharge, usual care would have been the preferred treatment.

Regarding the cost-utilities, the results presented suggest that costs were higher and effects were superior in the intervention group (fig. 1a -1b), although part of the intervention, namely early hospital discharge within five days, had not been successfully implemented as both groups showed a mean hospital stay of 9 days [23]. If early discharge had been implemented successfully, the new stroke care model would have been more effective, in terms of cost-utilities (Fig. 1c-1d) and cost-effectiveness (Fig. 2c-2d). Future research should be aimed at studying the effects after successful implementation of early hospital discharge.

To build this statistical model certain assumptions have been made. As both groups were not comparable at baseline with regard to age and activities of daily living, corrections for these differences were made. If these corrections hadn't been made the new stroke care model would have not been superior to care as usual in terms of cost-utility and cost-effectiveness. As other studies have shown, higher age and a lower BI are correlated with a lesser quality of life [24, 25]. In the intervention group participants were both significantly older and scored less on activities of daily living.

This study was undertaken from a societal point of view. Had it been undertaken from a healthcare only point of view, usual care would have been the treatment of choice, as Fig. 1e-1f and 2e-2f show. But with less than 4000 euros paid, the cost-effectiveness of the new stroke care model would be more than 90% in all three scenarios.

Study strengths and limitations

A strength of this study is the uniqueness of the care model investigated, for assessment and rehabilitation planning within a nursing home. To our current knowledge, this study is the first to examine the cost-utility and cost-effectiveness of such a care model. The effects of cost-effectiveness studies are usually measured with generic quality of life instruments to make comparison between different diseases possible. Apart from this, we also used a disease-specific quality of life instrument as this may be more sensitive to disease-specific changes. Although stroke patients in general are older and often less educated, both EQ-5D-3L and SASIP 30 are validated instruments for use in this group of patients. Our groups consisted of stroke patients capable of participating in a geriatric rehabilitation program. This means in general that they are able to use both EQ-5D-3L and SASIP 30. Another strength is the naturalistic setting of the trial that abled us to assess the cost effectiveness of the service in practice, as opposed to a trial study design where subjects are selected under ideal circumstances.

Locking at the patients groups the overall missings were relatively low with total data available for 227 (94.9%) of the participants. However we had a large number of missing data on both the SCT and Apraxia test (27.2% and 22.8%, respectively) in the experimental group. These missing data were caused by the incorrect assumption that the collection of these data was a structural part of the nursing homes' neuropsychological evaluation. Both generic as well as disease specific quality of life scores were not measured at baseline, because of the limited value of these measurements and the difficulty for many acute stroke patients to be tested in the very acute phase the disease. Missing EQ-5D-3L and SASIP 30 scores were replaced by the imputation of mean group scores, if all measurements of a patient were missing or by the imputation of a patient's previous or next measurement if only one measurement was missing. Patients with all data missing, on both costs and effect measurements, were not included in the analyses. Due to the small number of missing values of EQ-5D-3L (5.0%) and SASIP 30 (6.3%) scores, it's very unlikely that these had any effect on the outcomes.

Another limitation of this study is the non-randomised design. The study was carried out after the new stroke care model had already been implemented. It was not possible to organize a large RCT, with many participating regions consenting to expose themselves, or not, to early discharge from hospital and to assessment in a nursing home. The major disadvantage of our study design, as compared to an RCT, is that there is the potential that the intervention and control group are not strictly comparable. Another disadvantage of the study design is that the time horizon of this naturalistic trial is limited to 6 months, while the cost off-sets or health benefits could happen over a longer time period (at 1-year or lifetime).

The advantage being that a non-randomised control study reduces costs, is relatively simple and that there is a better investigators and participants acceptance. Both regions were selected because of the assumed comparability between regions with regard to the stroke patients treated, but to our surprise we found several baseline differences between the regions. These differences between the regions are most likely caused by the more advanced age of the population in the Maastricht area [26].

Of course the cost effectiveness of any stroke model is dependent of the entire pathway of care. Therefore both regions were also selected for their similarity in stroke service characteristics such as the time needed for presenting to the hospital, criteria for admission to the stroke unit and discharge planning. The timeframe of this study was kept short because of logistical reasons and because the economic effects of the intervention involved are shown within the first half year of stroke onset.

Conclusion

Based on the current study, we cannot give a definite answer whether the new stroke model is a good investment. Looking at the next step, if implementation of the new

stroke care model aimed at early hospital discharge and assessment and rehabilitation planning in a nursing home actually had succeeded, this would have been the preferred care model in terms of cost-utility and cost-effectiveness.

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Chapter 6

The Experiences and Opinions of Dutch Stroke Patients Regarding Early Hospital Discharge and Subsequent Rehabilitation Assessment and Planning in a Nursing Home

Ron WH Heijnen, Trudy DEM van der Weijden, Silvia MAA Evers, Martien Limburg , Jos MGA Schols.

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Abstract

Introduction: A new stroke care model has been developed in Maastricht, The Netherlands, in which patients only receive short-term acute care in the hospital. As soon as they are stabilised, patients are transferred to a special assessment and rehabilitation unit in a nursing home where the optimal rehabilitation track will be determined by means of a structured multidisciplinary assessment. It is not yet known how stroke patients experience this new care model and what their opinions are on it.

Objective: To explore stroke patients' experiences with and their opinions on this newly developed stroke care model.

Methods: Qualitative study among stroke patients admitted to the Maastricht University Medical Centre between September 2010 and January 2011, who underwent a multidisciplinary assessment in a nursing home as part of a newly developed stroke care model. Each link (hospital stay, transfer to and stay in the nursing home and return home) of this new care model was assessed by means of semi-structured interviews.

Results: Fourteen interviews were performed. Stroke patients stated that in general everything was well cared for and organised. They did not experience distorting problems with the care delivery. However, more attention has to be paid to the communication with the patients and their partners concerning the rehabilitation track.

Conclusion: The newly developed stroke care model is well experienced by patients. If this way of organising stroke care appears to be cost effective, the next step will be implementation in more nursing homes.

Introduction

Strokes have a profound effect on a person's life and also present a large economic burden to society [1]. Changes in delivery of healthcare, driven by the need to optimise the delivery of care and reduce costs, have resulted in shorter hospital stay and a decrease in the number of acute care beds in hospitals [2]. It is estimated that in the Netherlands the prevalence of stroke will rise until 2025 [3]. Accordingly, managing the growing number of patients suffering from strokes demands creative solutions without negative impact on stroke outcomes.

Early discharge from hospital followed by assessment of stroke-induced disabilities and rehabilitation planning in a nursing home setting might be a solution for the Netherlands, where 45% of stroke rehabilitation for especially older stroke patients takes place in nursing homes [4]. In contrast, only 13% of the stroke patients in the Netherlands rehabilitate in specialist rehabilitation clinics. These are mostly younger patients who still participate in employment [4]. The stroke service Maastricht Heuvelland introduced an innovative care model aimed at reducing hospital stays for stroke patients to five days, followed by assessment in a nursing home. The transition of the multidisciplinary assessment and treatment from the hospital to the nursing home should reduce delay in the rehabilitation track by withdrawing double work and unnecessary waiting [5].

In this new stroke care model, every stroke patient is admitted primarily to the Maastricht University Medical Centre's (MUMC) stroke unit. In the emergency ward, acute diagnostic tests are performed. In case of a confirmed stroke, the patient will be admitted to the stroke unit of the MUMC, where further diagnosis and treatment, including thrombolysis if indicated, are performed. Subsequently, the new stroke care model consists of a strict discharge regime from the neurology ward of the MUMC. All necessary tests and treatments in the hospital are planned within the first five days after admission. Thereafter, in principle, all stroke patients, regardless of age, are discharged to the stroke ward of a nursing home, where a comprehensive assessment takes place. Only patients who can be discharged home within five days after admission and those who are medically unstable will not be transferred to the nursing home. A skilled elderly care physician examines each patient immediately after arrival in the nursing home and initiates the assessment program. In this program, a multidisciplinary team consisting of a physiotherapist, occupational therapist, psychologist, speech therapist and trained nurses, examines the patient, by performing a structured assessment protocol. Following this assessment, the team will meet within five days of the patient's admission to the nursing home to make recommendations for a rehabilitation program specifically tailored to the patient. Rehabilitation can take place at home with outpatient care or by means of inpatient rehabilitation in a nursing home or a specialized rehabilitation centre. The development and implementation of this care model are described elsewhere [6].

During an earlier evaluation of this newly developed stroke care model, Van Raak et al. [7], in a single case study, found some issues threatening the model, namely the transport of stroke patients from the MUMC to the nursing home, a lack of communication between the different disciplines in the MUMC and nursing home and a lack of communication between caregivers and patients. They studied documents, interviewed managers and observed the care pathway, but they did not pay attention to patients' experience and opinions.

As part of a cost-effectiveness study of which the full protocol has been published elsewhere [8], this paper describes the outcomes of a qualitative study, identifying stroke patients' views on early discharge to and assessment in a nursing home, as part of the new stroke care model. Although effects and costs are important aspects for healthcare policymakers to base their decisions upon, we purposively aimed at describing any adverse effects as seen through the eyes of the patient.

The question we wanted to answer in this qualitative study was: What are the experiences and opinions of stroke patients with this newly developed care model?

Methods

Study design

A qualitative study design was used in which patients' experiences and opinions were assessed by means of semi-structured face-to-face interviews. We chose this method because it gave us the opportunity to discuss thoroughly the experiences of patients with the new stroke care model [9,10].

Recruitment and sampling

This qualitative study was part of a larger study, comparing cost effectiveness of the new stroke care model to care as usual [8]. All stroke-patients admitted to the neurological ward in the MUMC were given oral and written information about the main study during their hospital stay. The diagnosis of stroke was made by a neurologist based on patient history, physical examination and neuro-imaging. Patients needed to be over 18 years of age and speaking Dutch to participate in the study. Patients with a life expectancy of less than a few days, with a previous diagnosis of dementia, hospital discharge to home within a few days or the occurrence of complications, which required prolonged hospital care, were excluded from participation.

Between 20-10-2010 and 10-01-2011 patients were also informed about this qualitative study and could give written informed consent separately on this part of the study. We aimed to sample patients purposively regarding their route through the new stroke care model. For patients to be eligible to participate in the study, they needed to

be exposed to the intervention as intended. Patients were excluded if they were unable to communicate (e.g. because of severe aphasia) or had been diagnosed with dementia. About 4 weeks after admission to the MUMC, patients were visited and interviewed in their current living-situation. We chose this period as being long enough to ensure the assessment to have been finished and short enough to ensure that patients would still remember their experiences and emotions during hospital stay. We expected that data saturation would be reached after about 15 interviews. For this reason the number of patients to be included was 15-20 participants.

Data collection

To ensure the open character of the interviews, they were performed by an independent interviewer, who was not directly related to the project group. She was a final year medical student at Maastricht University at the time of the study and trained in taking open interviews. A topic list was developed for this study, based on the framework of the complex care innovation [10]. The main topics were the experiences during hospital stay, during transfer from hospital to the nursing home, and during the stay in the nursing home and, if applicable, after returning home again. Questions involved opinions on length of stay, experiences on the way patients were treated by healthcare providers, the organization of care and the information supply. All interviews were audio taped and transcribed verbatim.

Analysis

The interviews were analysed by directed content analysis [11]. After identifying and coding text passages relevant to the research question, the descriptive codes were compared and contrasted by sequential and retrospective searching within and among the interviews. The codes were then grouped into larger themes, explored further, structured, refined and reduced in number. Data was collected and analysed concurrently, allowing both expected and emergent themes and ideas to be incorporated and explored in subsequent interviews. Units of text referring to similar codes were grouped and categorized systematically by one central coder, who coded all the interviews. For the six richest interviews, the central coder and a second coder independently executed a full open coding of the transcript. Differences in coding were resolved by consensus discussion. The central coder then analysed the other interviews and the codes were checked by a second coder [12].

Results

Study population

We included 14 stroke patients in the study to assess their experiences and opinions with the redesigned stroke service. During the inclusion period it appeared that too few patients were participating in the study. Therefore, besides including acute stroke patients, we also looked back about five weeks, from 13-09-2010 till 20-10-2010 to ask patients retrospectively to participate in the interviews. We did this to be certain that we would manage to include enough patients. During two interviews the patient's partner was present.

Table 1. Patient and interview characteristics of the study population

Patient characteristics	n = 14
- mean age (SD) in years	72.7 (6.1)
- range in years	65 - 86
- % male / female	43 / 57
- % intracerebral haemorrhage / infarction	1 / 13
- mean MMSE score	27,2
Length of hospital stay	
- average (SD) in days	9.0 (3.2)
- range in days	4 – 16
Interview characteristics	
Time after admission to MUMC	
- mean (SD) in days	43.6 (23.1)
- range in days	29 – 107
- place of residence % home / nursing home	9 / 91
Length of interview	
- mean (SD) in minutes	24.6 (9.3)
- range in minutes	14 – 45

Table 1 shows patient and interview characteristics (time, place, length) of the participating patients. The average age was 72.7 years (SD 6.1 years) with a range of 65 to 86 years, 8 of these patients were female, 13 had a cerebral infarction, and 1 an intracerebral haemorrhage. The length of hospital stay varied from 4 to 16 days, with the average length of stay being 8.5 days (SD 3.1 days).

The interviews took place on average 43.6 days (SD 23.1 days) after admission to the MUMC, with a range of 29 to 107 days. In 91% of the cases the place of residence of the patient, at the time of the interview, was the nursing home, and in 9% their own home. The length of the interviews was on average 24.6 minutes (SD 9.3 minutes) with a range of 14 to 45 minutes.

Hospital stay

Four patients hadn't any recollection of their hospital stay, the others described it as strange, being in a foreign environment, hectic, tiresome and patients felt dependent. For the patients it was a difficult period, they just had a stroke and thus couldn't process everything around them with a lot of things happening at the same time.

> "You know, there is so much coming at you, you're in a foreign environment. It's all so difficult to comprehend at that moment, you are concerned about your own situation, not with all the things surrounding you, in a way, you just let it come over you"

However, none of the patients mentioned their stay in the hospital as being too busy or too short. Most patients thought their stay was long enough and some of them were even happy to go to the nursing home, due to the change of scenery and the fact that they could start their therapy there. One of the patients felt that the hospital stay was too long. This involved a stay of 16 days, which was the longest in the study population. One of the patients expressed negative experiences about the hospital stay and was rather emotional during the interview, because, during the stay in hospital this patient was tied to the bed. This patient also judged the nurses in the hospital as being strict. Generally, the patients judged the nurses to be adequate professionals, as they guided the patients where needed. Patients reported about tests being done in the hospital, but only one patient reported to have been exposed to therapy. Overall, patients stated that the information supply was deficient. Most of the times patients mentioned to be sufficiently informed about their medical condition, but stated that the consequences of their condition and the further care pathway were hardly explained. Also, one of the patients' partners mentioned that the information she got herself was inadequate, since she couldn't receive information from her husband.

> "What kind of tests was performed in hospital? I wouldn't know, we find the hospital did not inform us very well. We had to ask everything ourselves, and that was very annoying. My husband couldn't tell me whom he had seen. I found it very difficult that I was not informed of how he was doing or what tests were performed"

Transfer from hospital to nursing home

Most patients reported to have been informed about the transfer to the nursing home, but further explanation about why? was deficient. The only additional explanation or reason given for this transfer was in some cases that they would get therapy then and that the rehabilitation would start in the nursing home. It was only seldom mentioned that early and tailored determining of the best rehabilitation track was an important

goal of the transfer. One of the patients mentioned that a therapist in the hospital had remarked, one day before discharge, that they couldn't do more at the nursing home, than already had been done in hospital and in her opinion the patient could go home. However, this needed to be discussed with the neurologist, who only came one hour before discharge from the hospital. This patient was hoping to go home and was uncertain for quite some time.

Most patients were transferred to the nursing home with an ambulance, others went by transport provided by family. All patients were satisfied with their means of transport. In most instances one of the family members or another close acquaintance of the patient accompanied the patient, which was experienced as pleasant and supporting.

Stay at the nursing home assessment unit

Some of the patients reflected on the large differences in severity of impairments between the patients staying at the nursing home assessment unit. Patients with cognitive impairment stayed at the same ward as patients with hardly any cognitive problems. Some of the patients thought this was not helpful for their recovery and they would like these groups to be separated. Generally however, everything was experienced as well cared for and arranged in the nursing home rehab unit. One of the patients mentioned that medication in the morning was sometimes left behind in the bedroom or bathroom. Three patients complained of a lack of privacy.

> "I have been in the nursing home for four days. There is no privacy there. It was embarrassing, I stayed in a room with three ladies;… well the curtains were closed, but still you hear everything. In my opinion that's not right "

Patients indicated they couldn't remember everything that happened in the beginning when they arrived at the nursing home because of the many new impressions they had to process. As far as people remembered, they judged the information given to them at admission as good. There was a guided tour through the nursing home, an intake took place, and the program for the assessment as well as the subsequent rehabilitation programme was explained. However, the most important issue for the patients was getting home as soon as possible. The patients were motivated to recover, they were eager to learn how to walk again, and as long as they saw progress they accepted their stay at the nursing home.

Most of the times patients could not really distinguish between the assessment in the beginning and the actual rehabilitation track that followed. Some of the patients mentioned there had been a screening in the hospital, just like the one they got in the nursing home, so this was kind of a repetition, which they thought was needless. In general patients experienced the assessment not as annoying. The nursing home professionals involved in the assessment and therapies were viewed as nice and kind. They

gave good guidance and support, explained what they wanted to do, and everything happened in a calm way. None of the patients experienced the assessment as being too busy, some of them saw it as a distraction from their daily routine. Since some patients did not process everything in the beginning that well, they could not remember the overall advice given at the end of the assessment. The fact that their progression was discussed after a period was experienced as favourable, since patients could process this information better at a later point during their stay in the nursing home.

The nurses on the ward were described as good, sometimes even great, kind, helpful and humane. Some patients were disturbed by the noise nurses made, especially during the night or in the early morning and others would like nurses to interact more with them and sometimes chat to them. Some patients expressed their concerns for the nurses' job quality.

> "They are all nice girls, really. But they have to run all day long. They are very busy and yet they stay polite. They work under pressure and it's difficult to stay polite, under pressure. I think they are trained for it".

Patients felt that, besides the therapies, there were few other rehab stimulating activities resulting in patients often just sitting in their chairs when they had no formal treatment sessions. This was regarded as annoying by some patients. Most patients liked and could understand the treatment approach that was followed during the rehabilitation, which involved that they had to do things themselves as much as possible, and that they only got help when needed.

Return home

Some of the interviewees already had returned to their own home or would do so on short term. These patients were content about the time in which everything was arranged and they mentioned that at a certain point they were ready to go home and were looking forward to it. Patients thought it was favourable to first have a home visit or a weekend leave before they returned home permanently, because this made them more confident.

They experienced it as nice that therapists made one or more home visits with them before discharge. These visits were part of the structural evaluation before returning home. Patients felt satisfied about the guidance from the nursing home related to the transition to their original home situation; it happened in a nice way, not threatening, and a lot of tips were given, also for their partners. In the new stroke care model patients are also visited at home by a home care coordinator a few weeks after their nursing home discharge. This is a specialised stroke nurse who assesses the actual home situation after discharge and organises extra help if needed. None of the interviewees had been visited by the homecare coordinator yet, but some had an appointment and

they thought it was a good initiative to check the situation a few weeks after returning home.

Discussion and Conclusion

The interviewed stroke patients involved in this new stroke care pathway stated that in general everything was well cared for and organised during their rehabilitation track. They did not experience distorting problems with the care delivery. Some patients complained of a lack of privacy in the nursing home, a lack of activities in the nursing home, the repeating of screenings or of lack of communication on the rehabilitation track in the hospital phase.

Comparison with existing literature

Since our study is among the first to explore the experiences and opinions of stroke patients on redesigned care processes under study, few is known about this subject.

Causes of privacy disturbance, such as multiple-occupancy rooms, and limited efforts by caregivers to reduce noise, as mentioned by our patients during the stay in the nursing home setting, were also found by others [13]. A single-occupancy room favours privacy and allows families to participate in care. In the Netherlands, over the last years general improvements are being made in patients privacy, aiming at all patients having their own room in the nursing home rehabilitation setting.

The lack of activities between rehab therapies, as stated by our patients, is consistent with the quantitative findings of Buijck et al [14]. They found that stroke patients in a nursing home setting spent 43,5% of the day on non-therapeutic activities (mostly sitting, laying). The role of nurses is seen as very important in assisting patients to engage in therapeutic and other activities [15,16]. But as our patients also mention, the workload of nurses is seen as heavy and without more resources this will become even heavier, as stroke incidence will rise over the coming years, leading to survival of more and more patients with cardiovascular diseases, who need complex (rehab) care services, that have to be provided in a time in which care organizations continuously face budget cut [3].

The transition of the multidisciplinary assessment and treatment from the hospital to the nursing home should reduce delay by withdrawing double work and unnecessary waiting [5,14]. However, in our interviews patients reported there is still double work being done, namely a sort of assessment done in the hospital, which was repeated more extensively in the nursing home. This suggests even more time can be saved by better attuning of the assessments. The question is whether this time can be saved in the hospital or in the nursing home, or maybe even in both.

In 2006 it turned out that the transport of patients from the hospital to the nursing home was a weak link in the stroke care chain [7]. The main reason for this problem was that ambulance services were not assigned to this task and patients often had to wait or arrange their own transport. New appointments were made to resolve this problem and from our interviews we can conclude that most of the patients are transferred using an ambulance, but also family members and other close contacts of the patient are still asked to transport the patient. However none of the patients reported having had problems with their means of transport.

With the implementation of the newly developed integrated care pathway for stroke patients, a faster care delivery has been established, initiated in the nursing home setting where all patients could start their rehabilitation track after 3 days of assessment. Although the patients in our study are generally satisfied with the medical information given to them by nurses and physicians, they complain about a lack of timely information supply concerning their individual care pathway. Good and timely communication with the patient and their partners about the care pathway is necessary. A case manager that follows the patient through the care pathway and provides timely information could be a solution for this problem.

Strengths and limitations

The most important strength of this study is that, as far as we know, this is the first to evaluate patients' experiences with and their opinions on a newly developed integrated care pathway for stroke patients. We included a diverse sample of stroke patients, e.g. both sexes, different ages and different stroke types (infarction as well as intracerebral haemorrhage).

We did not manage to include 15-20 patients, as was our primary goal. Though only 14 patients could be included, this doesn't mean that their opinions and experiences are less meaningful or significant. Moreover, we think we performed enough interviews to reach data saturation, as we did not distract new findings after 10 interviews. All interviews were audio taped and transcribed verbatim, except for one due to technical problems. During this interview the interviewer took notes and transcribed these directly after the interview.

Most patients were still staying in the nursing home at the time of the interview. This means that the patients are still dependent on the staff at the nursing home and that they may not have been completely open about the aspects concerning their stay at the nursing home. We tried to avoid these influences by using an independent interviewer. Before every interview we also emphasized that all answers given would be treated confidentially, processed anonymously and that the audiotapes would only be used by the interviewer to work out the interviews.

During the interviews it appeared that patients did not pick up everything in the acute phase, and thus remembered little about this period. Because of this, the findings

concerning the acute phase may be incomplete. One can doubt whether the patients who were dissatisfied about the information they got in the hospital, really did not get information, or just did not remember it. However, one of the patients' partners also stated that the information supply in the hospital was suboptimal. The mean MMSE scores of the interviewed group was 27.2 (max. 30); this indicates that there were no major memory problems in this group.

Implications

In general, the patients stated that they were well cared for and that they did not experience any significant problems with the newly developed integrated care pathway. The preliminary outcomes of the cost effectiveness study are in support of the new care model and the qualitative findings in this paper show that patients' experiences are not obstructing its implementation either. However, more attention has to be paid to good and timely communication with patients and their partners. Future studies might provide more insight into the prolonging effects of this new stroke model and in the course of the perspectives and experiences of patients, family caregivers and care providers involved in it.

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Chapter 7

General Discussion

Introduction

Healthcare organisations in western countries, including the Netherlands, struggle to counter ever growing numbers of stroke patients [1]. Early discharge from hospital followed by assessment of stroke-induced disabilities and rehabilitation planning in a nursing home setting might be a solution for this struggle. Therefore the stroke service Maastricht - Heuvelland introduced an innovative care model aimed at reducing the length of hospital stay for stroke patients to five days, followed by assessment in a nursing home to assess the best individual rehabilitation track.

In this thesis an evaluation was performed of this new stroke care model. The hypothesis was that the new model makes care for stroke patients more cost-effective and accessible, without negatively influencing functional outcomes, quality of life or satisfaction with care.

The following research questions were addressed:

1. What is the effect of early admission to and assessment in the nursing home of stroke patients on actual length of hospital stay and quality of life, functional outcomes, and satisfaction with care of patients? (Effect evaluation)
2. What is the estimate cost-utility and cost-effectiveness of the new stroke care model, from a societal perspective, in which relevant costs and effects are taken into account, in comparison with the usual care provided by a regular stroke service? (Economic evaluation)
3. What are the experiences and opinions of stroke patients regarding early hospital discharge and subsequent rehabilitation assessment and planning in a nursing home? (Process evaluation)

To answer these questions, the integral evaluation study of this new stroke care model involved an effect evaluation, a process evaluation and an economic evaluation executed by comparing two groups of acute stroke patients who were over 18 years of age and admitted to either a hospital in the intervention or the control region. In this general discussion, the main findings of the study are summarized and discussed; thereafter methodological strengths and limitations are reported, and clinical implications and suggestions for future research are addressed.

Main findings

Effect evaluation

Length of hospital stay and process-related outcomes

One of the main objectives of the innovative stroke care pathway, namely early discharge from hospital to a nursing home within five days after stroke, was not achieved.

We found that the mean duration of hospital stay was comparable in both groups (9 days). Although there were no differences in the length of hospital stay between both groups, there were some relevant differences between groups on other indicators. In the intervention group, as was intended, significantly more patients were admitted to the nursing home than in the control group (66% in comparison with 25%). In the control group significantly more stroke patients were discharged home after their initial hospital stay (68% compared to 24%). All nursing home patients in the intervention group were exposed to the nursing home assessment within 3 days after admission. Accordingly, one can conclude that the second objective of the intervention, namely assessment in the nursing home, was implemented considerably well, although with a delay of about 5 hospital days.

Internationally, the length of hospital stay after stroke varies between 10 and 42 days [2]. At the time of this study, the duration of hospital stay of Dutch stroke patients was 9 days on average. Unfortunately comparison is difficult because of differences in the way rehabilitation is organised in different countries. Dutch hospitals in general are not equipped for a rehabilitation function related to older patients and therefore patients which cannot return home directly after their stroke, are transferred to specialist rehabilitation centres or to geriatric rehabilitation facilities in nursing homes, especially when they are older and rehabilitation towards employment is not the aim anymore. In the Netherlands, in fact we have already managed to shorten hospital stay for stroke patients considerably by arranging early hospital discharge home or to a specialised nursing home facility for the majority of stroke patients; though a further reduction of the duration of hospital stay, which was the aim of our study, could apparently not be achieved.

Patient related outcomes

As mentioned earlier, we hypothesised that the new stroke care model would not affect quality of life, functional outcomes, and satisfaction with care in a negative way. This hypothesis was confirmed. There were no significant differences between the intervention and usual care group in general quality of life (Euroqol-5D; EQ-5D), disease specific quality of life (Stroke Adapted-Sickness Profile 30; SA-SIP30), activities of daily living (Barthel Index; BI), cognitive functioning (Mini Mental State Examination; MMSE, Aphasia Test; AT, Hospital Anxiety and Depression Scale; HADS), satisfaction with stroke care (Satisfaction with Stroke Care Questionaire-19; SASC). Furthermore, there were no significant differences between both groups in medical complications, hospital readmissions or deaths between both groups.

The only significant difference found, was in the score for instrumental activities of daily living, measured with the Frenchay Activities Index (FAI). At six months after stroke, the usual care group scored 2 points higher on the FAI. Although this difference was statistically significant, clinically a difference less than 4 points on the FAI can be regarded as irrelevant [3]. The difference found might be explained by more patients in

the control group being discharged home, directly after hospital stay (68% versus 24%). Being at home might affect the FAI in a positive way as the skills measured by this scale are more often used at home. This effect was also found by others [4,5].

The functional outcomes related to activities of daily living, found in our study, are comparable to outcomes found by others, six months after stroke [6,7]. But both the intervention and the control group scored higher on general quality of life (EQ-5d) than was reported in other studies [8,9]. In a study by Baeten et al. BI scores were lower and patients stayed in hospital much longer (mean 26 days). This might have accounted for the lower quality of life scores found. In a study by Cramm et al. general quality of life was measured before hospital discharge (on average 12 days after stroke) which could also have led to lower scores. Satisfaction with stroke care scores did not differ between the intervention and control group and are comparable with scores found by others [9,10].

There were no significant differences in hospital re-admission within 6 months after stroke, between both groups, respectively 9.9% in the intervention and 8.7% in the control group. This is in accordance with the national hospital re-admission score of 8.4% [11] but much lower than international scores, which range from 18% to 39.5% [12,13].

Process Evaluation

The methods of the process evaluation were limited to only describing the experiences of the stroke patients themselves. In general, most patients stated that they were well cared for and that did not experience any significant problems with the new stroke model. However, an issue that was mentioned often was that more attention should have been paid to adequate and timely communication with patients concerning their individual care pathway. This was also found by Cameron et al. in their review on stroke survivors' and family caregivers' experiences with transitions across care environments [14] and by Everink et al. who studied the experiences of patients with implementing an integrated geriatric rehabilitation care pathway for geriatric patients with complex health problems [15]. A case manager, who oversees a patient's entire care career and supports the patient as he or she crosses multiple care environments and who also provides timely and tailored information, could be a possible solution for this problem [16].

Many patients, who during the study stayed in two- or even four-person bedrooms, mentioned a lack of privacy in the nursing home rehabilitation setting. Most of them desired a single room, as they valued their privacy as very important. In the meantime, since the time of the study execution, general improvements have been made in patients' privacy in our country, aiming at hosting each patient within a nursing home rehabilitation setting in a single-person room. The question is whether this positively meant change actually contributes to the rehabilitation climate itself. A single room

might somehow be too comforting for short-term rehabilitation towards the original home situation. Buijck et al. showed that most stroke patient in nursing home rehab facilities often stay in their room half of the time during their rehabilitation [17], whereas a therapeutic climate in which nurses play an important role and in which patients are directed to general rehabilitation spaces in between resting periods, is needed [17].

Economic evaluation

The economic evaluation was conducted from a societal perspective, in which relevant costs concerning intervention, healthcare and patients' costs are included. Costs were measured at three and six months using cost questionnaires especially designed for stroke patients. Overall, the results showed that costs were higher in the intervention group than in the control group (mean €22.009 versus mean €19.769). The difference was mainly caused by higher healthcare related costs in the intervention group. Especially costs related to nursing home stay and costs for day care caused the difference. Two other Dutch studies evaluated the total costs for stroke patients during their first half-year after stroke and found similar costs. For instance, Baeten et al., in a study using data from the older EDISSE (Evaluation of Dutch Integrated Stoke Services Experiments) study, found mean total costs of €21.665 and Eeden et al. (mean €21.730) for Dutch stroke patients within six months after as well stroke [18,19]. However, it is difficult to compare these studies with our study because the stroke pathways were different. Internationally, comparison of stroke costs is almost not feasible due to the differences in health care organisation and due to a large variety in patient populations, methodology, data collection, follow-up time and perspectives.

Using the SASIP 30, a stroke specific quality of life instrument, to analyse the cost effectiveness of our new stroke model we found that with a willingness to pay €7.000, the new stroke care is very likely to be more cost effective than care as usual. However, based upon this study alone, we cannot give a definite answer whether the new stroke model is a good investment. If implementation of the new stroke care model would actually had fully succeeded, with a reduction of hospital stay to 5 days, this would definitely have been the preferred care model in terms of cost-utility and cost-effectiveness.

Why was early discharge from hospital not accomplished?

In the next part of this discussion we now want to focus on the most relevant question that remained after conducting our studies, namely: "*Why was early discharge from hospital not accomplished?".*

Directly after implementing the new stroke care model in the region of Maastricht University Medical Centre, Vos et al. conducted a case study among 51 stroke patients. They found that at that moment the hospital discharge for stroke patients occurred to

be on average 7.3 days after admission [20]. Despite the small number of patients they included and the limited timeframe of inclusion (3 months), we concluded from the results of their study that the originally aimed 'hospital discharge within 5 days' for our study seemed feasible. However, the results of our study did not confirm this. In fact we found an average of 9 days of hospital stay for both groups.

There could be several reasons why the (further) early discharge from hospital could not be accomplished. First, the change in routines, both in the hospital- and the nursing home setting, implied a shift in tasks for healthcare professionals of both settings that had to work in the new stroke care model. Some hospital professionals, especially hospital physiotherapists and rehabilitation specialists, lost their function in the assessment of stroke patients, because this was taken over by the professionals in the nursing home. As van Raak et al. showed, this can be perceived as a threat by some of the hospital professionals, who did not want to work according to the new routines. Subsequently, this might have led to longer hospital stays [21].

Another explanation for not achieving early hospital discharge could have been the rather often occurring turnover of hospital personnel during the 18-month inclusion period of the study. These changes might have led to unfamiliarity with newly adopted hospital procedures, resulting in sticking to the traditional routines. Also lack of coordinating the working hours of employees of the "hospital discharge office" could have contributed to not achieving timely hospital discharge. The "discharge office of the hospital" coordinates the patients' transfers from the hospital to the nursing home. A staff member of this office visits the patients prior to discharge, informs them of the rehabilitation track to be followed and arranges the transfer. This function is vital for maintaining an adequate and continuous patient flow. Due to the fact that the two employees consigned to this task initially did not succeed in coordinating their working hours to ensure fulltime staff availability, transfers could not always be planned in time. Finally, inadequately managing adherence to the care pathway related appointments might be another reason. In addition, the early enthusiasm of the team may have eroded during the years following implementation, as the stroke care coordinator had resigned during the period of the study, and who in fact for a very long time was essential for monitoring the right execution of stroke care in the region.

New developments over time that may affect the duration of hospital stay

A changing reimbursement system

Since the start of our study, several changes in the organisation and payment regimes of Dutch healthcare have taken place. One of the major changes was the introduction of prospective payments methods based on a diagnosis related group system, called Diagnosis treatment Combinations (in Dutch DBCs), to set payments based on estimated nursing home costs for different patient groups in advance of service provision. During

our study however, nursing homes were still paid on fixed amounts of Euros per bed and bed days.

This new payment regime makes the originally expected outcomes of our study still relevant at this moment, because this regime nowadays actually 'facilitates' early discharge by means of financial stimulation. Hereby hospitals and nursing homes are not settled on empty beds anymore but are stimulated to produce more DBCs by realizing a higher patient turnover. Bouwstra et al. showed that after 2014, when the new payment system was implemented in geriatric rehabilitation, higher treatment intensities and shorter length of stay were found for all types of geriatric rehabilitation patients except for patients with a joint replacement [22]. The effects they found on length of stay by intensifying assessment and treatment in the nursing home setting are similar to the one found in our study.

Early supported discharge

Internationally, to reduce hospital stay for stroke patients, nowadays a trend is seen towards organising early supported discharge (ESD) services, meaning services which offer hospitalised stroke patients an early discharge with the continuation of rehabilitation at home, supported by an interdisciplinary team with specialised stroke competence. Although Fens et. al showed that there is only limited evidence for the effectiveness of multidisciplinary community based rehabilitation programmes for community living stroke patients after being discharged home [23], a recent Swedish study showed that when the multidisciplinary team is both responsible for co-ordination of the discharge and for the continued rehabilitation in the home environment, patients have shorter hospital stays, are less care dependent related to their activities of daily living (ADL) and are more satisfied with care [24]. Although the effects of ESD seem positive, this Swedish study also showed that only slightly more than one-fourth of the patients who might have benefitted from ESD services actually received the service, because the moderate to severally ill stroke patients or those who lack caregivers at home, cannot participate.

Although others have proven that hospital stroke units and early supported discharge (ESD) programmes my successfully shorten length of hospital stay after stroke [2,24], we did not find any similar studies concerning early hospital discharge to nursing homes for stroke patients (geriatric rehabilitation) as was the concept of our study. A study by van Balen et al., in another diagnosis group, showed that early discharge of hip fracture patients from hospital to a nursing home, reduced hospital length of stay by 7 days, without significant differences in mortality, activities of daily living, complications or quality of life [25].

Methodological strengths and limitations

This is one of the first studies to explore care pathways in geriatric stroke rehabilitation, evaluating an intervention in terms of effectiveness, process as well as economic impacts. The uniqueness of the care model investigated, with assessment and rehabilitation planning in a specialized nursing home setting, makes our study a valuable addition in the field of research evaluating care for stroke patients. The naturalistic setting of the trial enabled us to assess the cost effectiveness of the service in practice, as opposed to a trial study design where subjects are selected under ideal circumstances.

However, a limitation of the study is the non-randomised design. A randomised controlled trial (RCT) is normally chosen as design for studies evaluating the effect of a healthcare innovation. Our study was carried out after the new stroke care model had already been implemented. It was not possible to organize a large RCT, with many participating regions that would consent to expose themselves, or not, to early discharge from hospital and nursing home assessment. The major disadvantage of our study design, as compared to an RCT, is that the intervention and control group may not be strictly comparable. As our study showed, both regions were selected because of the assumed comparability between the regions with regard to the stroke patients treated. Nevertheless, we found several baseline differences. The differences between the regions were most likely caused by the more advanced age of the stroke population in the Maastricht area [26]. This involved that the intervention group was significantly older, scored worse on activities of daily living and participants were less well educated. In our analyses we statistically corrected for these baseline differences.

Another limitation could have been the generic quality of life instrument chosen to perform the cost-utility analysis. Although the EQ-5D is a validated instrument, obliged and widely used in cost-utility analyses, strokes affect not only physical and psychological functioning but also social functioning, an aspect not adequately covered by the EQ-5D. As generic measures such as the EQ-5d do not take fully into account stroke specific impairments, for future research we advise using stroke specific quality of life instruments.

With regard to the qualitative study we only performed interviews with patients, due to limited time for the process evaluation and the fact that the mean investigator was part of the care process. Conducting interviews with professionals participating in the new care model could have been interesting and probably would have given extra insight in why early hospital discharge was not achieved.

Implications for clinical practice

From an international perspective, the Dutch stroke services perform very well. The length of hospital stay is already one of the shortest in Europe, functional outcomes and costs are comparable to other European countries and satisfaction with stroke care is

high. Despite that, future pressure on the healthcare delivery systems, due to aging of the population, demands for additional creative solutions.

From our study, it appeared that from all patients assessed in the nursing home, in the intervention region almost twice as many patients received subsequent rehabilitation care in the nursing home than was the case in the control group. This subgroup of patients stayed on average less longer in hospital and was discharged earlier from the nursing home than was the case for stroke patients that received rehab care in nursing homes in the control region.

The assessment in the nursing home was extensive, but all patients were assessed within 3 days. So the capacity to assess large numbers of patients while achieving a better length of stay in the nursing home is possible. In this way, rising numbers of older stroke patients might be handled in nursing home geriatric rehab settings and if this could be combined with a multidisciplinary ESD team that is both responsible for geriatric rehabilitation in the nursing home, co-ordination of the discharge and for the continued rehabilitation in the home environment during a certain time period, this could be very promising. Such a trajectory therefore deserves further exploration.

Implications for further research

Future research should focus on assessment teams for stroke patients directly following acute care in a hospital. As our study indicates it is feasible that these are more cost-effective by reducing hospital stay to a minimum. To validate our findings, new studies should aim at the effects of fully implementing the new stroke care model. Related to this, studies should also be aimed at exploring the effects of the most relevant elements of the total geriatric rehab care pathway, meaning: 1) early hospital discharge to a nursing home, 2) tailored assessment in the nursing home geriatric rehab setting, 3) continued rehab in the setting which is most suitable for the patient and if this is the home situation or the nursing home rehab setting also 4) the temporary ambulatory continuation of rehabilitation at home, by the multidisciplinary nursing home stroke team. In addition, research into a better measure of QoL of stroke patients should be performed.

Finally, future studies should also provide more insight into the course of the perspectives and experiences of patients, family caregivers and care providers involved in it. This means that more extensive process evaluations should be performed.

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Summary

Summary

In Chapter 1, a general introduction into the background of this thesis is given. In the thesis an evaluation was performed of a new stroke care model, which combines early hospital discharge to a nursing home with assessment and rehabilitation planning in the nursing home. The hypothesis was that the new stroke model makes care for stroke patients more cost-effective and accessible, without negatively influencing functional outcomes, quality of life or satisfaction with care.

Chapter 2 describes the development towards the new (integrated) stroke care model in the region of Maastricht during the last 15 years. Integration was needed to improve the continuity, coordination and quality of stroke care. In reworking and developing the care process, a redesign took place to emphasize early discharge from hospital and assessing the best individual rehabilitation track in the nursing home. The development and implementation of this new stroke care model in the region of Maastricht led to a shorter length of hospital stay, more patients being directly admitted to the hospital stroke unit and an earlier start of rehabilitation. But the implementation of the new stroke care model also led to some unforeseen problems and lessons learned. As experiences with the first patients showed, in general patients did not associate a nursing home with a quick discharge to their own home, but with a long or even permanent residency. A shift of tasks from hospital professionals to professionals working in the nursing home led to resistance on part of the hospital professionals. Also a better coordination of working hours between employees of the hospital discharge office was needed, by which patient transfers might have been better planned in time.

Chapter 3 describes the design of the non-randomised comparative study evaluating the new model involving early admission to a nursing home, with multidisciplinary assessment, for stroke patients. The design involved a non-randomised comparative trial for two groups. Participants were followed for 6 months from the time of stroke. The intervention consisted of a redesigned care pathway for stroke patients. In this care pathway, patients were to be discharged from hospital to a nursing home within 5 days, in comparison with 10 days in the “care as usual” situation. In the nursing home a structured assessment took place, aimed at planning adequate rehabilitation. People in the control group received usual care, with a less extensive assessment in hospital. The primary outcome measures of the effect evaluation were quality of life and activities of daily life (ADL). Quality of life was measured with a disease specific (SASIP-30) and a generic (EQ-5D-3L) quality of life instrument and ADL by means of the Barthel index (BI). Secondary outcome measures were: instrumental activities of daily living (IADL) measured by means of the Frenchay Activity Index (FAI), handicap(s) measured by means of the Modified Rankin Scale (MRS). Cognitive functioning was measured by means of Mini Mental State Examination (MMSE), Apraxia Test (AT) and Star Cancellation Test (SCT). Anxiety and depression were measured by the Hospital Anxiety and Depression Scale

(HADS) and the patients' satisfaction with stroke care was measured by means of the Satisfaction with Stroke Care Questionnaire (SASC-19). The strain on caregivers was measured by the Caregivers Strain Index (CSI). Other secondary outcome measures were medical complications occurring within 3 months after stroke. The following diagnoses were regarded as medical complications: a new stroke, epileptic seizures, pneumonia, urinary tract infections, fractures, bedsores, myocardial infarct, heart failure and atrial fibrillation. The data on medical complications was collected from the patients' files. Besides the primary and secondary outcome measures we assessed some background variables which were considered to be predictors, confounders or effect modifiers. The following personal characteristics were assessed: age, sex, socio-economic status, risk factors, co-morbidity, stroke location and stroke severity measured by the National Institute of Health Stroke Scale (NIHSS). All background variables were measured at baseline. In addition, an economic evaluation was performed from a societal perspective and a process evaluation was carried out to evaluate the feasibility of the intervention as well as the experiences and opinions of patients.

Chapter 4 presents the results of the non-randomised comparative study, looking at effects of early hospital discharge and assessment and rehabilitation planning in a nursing home on quality of life, functional outcomes and satisfaction with care. 239 acute stroke patients participated in this study: 122 in the intervention and 117 in the control group. We did not succeed in implementing early discharge from hospital, although the systematic assessment in the nursing home was accomplished. No clinically relevant differences were found between the groups for functional outcomes, quality of life or satisfaction with care. In comparison with the control group, a trend towards reduction in length of nursing home stay was found in the intervention group for those patients that after the assessment got rehab care in the nursing home.

Chapter 5 presents the outcomes of a study to assess the cost-utility and cost-effectiveness of the new stroke care model aiming at the early discharge of stroke patients from hospital to a nursing home for systematic assessment and planning rehabilitation. The economic evaluation was embedded in the non-randomised comparative trial for which 239 acute stroke patients were recruited from two stroke services in the regions of Maastricht and Eindhoven. Self-reported costs and quality of life were assessed during a 6-month follow-up period. Quality of life was measured with a disease specific (SASIP-30) and a generic (EQ-5D-3L) quality of life instrument. The economic evaluation was conducted from a societal perspective. Uncertainty was accounted for by bootstrapping and sensitivity analyses. Overall costs were higher in the intervention group (I: mean= €22009, 95%CI: 21720, 22298; C: mean= €19769, 95%CI: 19430, 20108). The cost-utility analyses, using generic quality of life as the outcome measure, showed that the new model for stroke care was more efficient, at a Willingness to Pay threshold of €50,000 per Quality Adjusted Life Year (QALY). Using disease-specific quality of life as an outcome measure, the cost-effectiveness analyses showed that the new

stroke care model was more effective and more expensive in comparison with care as usual. To our knowledge this is the first study to determine the cost-utility and cost-effectiveness of a stroke service aimed at early hospital discharge with subsequent assessment and rehabilitation planning in a nursing home. With a willingness to pay 50,000 euros for a Quality Adjusted life Year gained, the new stroke care model proved, with a probability of 76% to be more cost effective.

Chapter 6 presents the outcomes of a qualitative study, to explore stroke patients' experiences with and their opinions on this newly developed stroke care model. A qualitative study among stroke patients admitted to the Maastricht University Medical Centre between September 2010 and January 2011, who underwent a multidisciplinary assessment in a nursing home as part of a newly developed stroke care model. Each link (hospital stay, transfer to and stay in the nursing home and return home) of this new care model was assessed by means of semi-structured interviews. Fourteen interviews were performed. Stroke patients stated that in general everything was well cared for and organised. They did not experience distorting problems with the care delivery. However, more attention has to be paid to the communication with the patients and their partners concerning the rehabilitation track.

Chapter 7 concerns the general discussion of the thesis and provides an overview of the main findings. Theoretical considerations, methodological considerations and also recommendations for both daily practice and future research are presented.

Samenvatting

Samenvatting

Hoofdstuk 1 geeft een algemene inleiding in de achtergronden van dit proefschrift. In het proefschrift wordt een nieuw zorgmodel geëvalueerd, dat een vroeg ontslag uit het ziekenhuis combineert met het beoordelen van het revalidatiepotentieel en revalidatieplanning in het verpleeghuis. De hypothese is dat dit nieuwe zorgmodel de zorg voor patiënten met een beroerte kosteneffectiever en toegankelijker maakt, zonder dat het functioneren, de kwaliteit van leven of de tevredenheid met de geleverde zorg afnemen.

In hoofdstuk 2 worden de ontwikkelingen beschreven die, gedurende de afgelopen 15 jaar hebben geleid tot het ontstaan van het nieuwe zorgmodel voor patiënten met een beroerte, in de regio Maastricht. Integratie was nodig om de continuïteit, coördinatie en kwaliteit van de zorg voor patiënten met een beroerte te verbeteren. Daartoe heeft er een herontwerp van het zorgproces plaatsgevonden, waarbij de nadruk ligt op vroeg ontslag uit het ziekenhuis en vervolgens de inschatting van het beste individuele revalidatietraject in het verpleeghuis plaatsvindt. De ontwikkeling en invoering van dit nieuwe zorgmodel in de regio Maastricht heeft geleid tot een kortere opnameduur in het ziekenhuis. Ook konden meer patiënten rechtstreeks op de stroke unit worden opgenomen en starten er meer vroegtijdiger met hun revalidatie. Maar de invoering van dit nieuwe zorgmodel leidde ook tot enkele onvoorziene problemen en leermomenten. Zoals de ervaringen met de eerste patiënten toonden, associëren velen van hen een verpleeghuis niet met een snel ontslag naar huis maar eerder met een lang of soms zelfs permanent verblijf. De verschuiving van taken, van ziekenhuisprofessionals naar professionals die in een verpleeghuis werken, leidde bovendien tot verzet van de kant van de ziekenhuisprofessionals. Verder was er een betere afstemming van de werktijden van medewerkers van het ontslagbureau in het ziekenhuis nodig, zodat overplaatsingen beter gepland konden worden.

In hoofdstuk 3 wordt een beschrijving gegeven van de vergelijkende studie naar de effecten van het nieuwe zorgmodel voor patiënten met een beroerte. Het design betrof een niet gerandomiseerde vergelijkende studie voor twee groepen. De proefpersonen werden na de beroerte 6 maanden gevolgd. De interventie bestond uit het volgen van het nieuw vormgegeven zorgpad voor patiënten met een beroerte. Patiënten zouden binnen 5 dagen van het ziekenhuis naar het verpleeghuis worden ontslagen, in vergelijking met 10 dagen bij de controlegroep. In het verpleeghuis vond een gestructureerd assessment plaats, gericht op een adequate revalidatieplanning met nadien starten van het geïndiceerde revalidatietraject. De mensen in de controle groep kregen de gebruikelijke zorg, inhoudende een minder intensief assessment gedurende de in principe langere ziekenhuisopname met vervolgens starten van het geïndiceerde revalidatietraject. De primaire uitkomstmaten van de effectevaluatie waren Kwaliteit van Leven en Activiteiten van het Dagelijks Leven (ADL). De Kwaliteit van Leven werd zowel gemeten

met een ziekte specifiek (SASIP-30) als een generiek (EQ-5D-3L) Kwaliteit van Leven instrument en de ADL functies werden gemeten met de Barthel index (BI). De secundaire uitkomstmaten waren: instrumentele activiteiten van het dagelijks leven (IADL) gemeten met de Frenchay Activity Index (FAI), handicap(s) gemeten door middel van de Modified Rankin Scale (MRS). Het cognitieve functioneren werd gemeten met de Mini Mental state Examination (MMSE), Apraxia Test (AT) en de Star Cancellation Test (SCT). Angst en depressie werden gemeten met de Hospital Anxiety and Depression Scale (HADS) en de patiënttevredenheid met de geleverde zorg werd gemeten met de Satisfaction with Stroke Care Questionnaire (SASC-19). De druk op de mantelzorg werd gemeten met de Caregivers Strain Index (CSI).

Andere secundaire uitkomstmaten waren medische complicaties, ontstaan in de eerste drie maanden na de beroerte. De volgende diagnoses werden daarbij gezien als medische complicaties: een recidief beroerte, epileptische insulten, luchtweginfecties, urineweginfecties, fracturen, decubitus, myocard infarct, hartfalen en atriumfibrilleren. De gegevens over de medische complicaties werden verzameld uit de medische dossiers. Behalve de primaire en secundaire uitkomstmaten werden relevante achtergrondvariabelen verzameld, die als predictors, confounders en effectmodifiers konden worden beschouwd. De volgende persoonlijke kenmerken werden onderzocht: leeftijd, geslacht, sociaal economische status, co-morbiditeit, locatie en ernst van de beroerte gemeten met de National Institute of Health Stroke Scale (NIHSS). Alle achtergrondvariabelen werden ten tijde van de nulmeting verzameld. Aanvullend werden ook een economische evaluatie uitgevoerd vanuit een maatschappelijk perspectief en een procesevaluatie om de haalbaarheid van de interventie alsook de ervaringen en meningen van de patiënten te evalueren.

In hoofdstuk 4 worden de resultaten beschreven van de niet gerandomiseerde vergelijkende studie naar de effecten van vroeg ontslag uit het ziekenhuis met assessment en revalidatieplanning in het verpleeghuis op de kwaliteit van leven, functionaliteit en tevredenheid met de geboden zorg. Er participeerden 239 patiënten met een acute beroerte in de studie, gerekruteerd van twee stroke services in de regio Maastricht en Eindhoven : 122 in de interventie groep en 117 in de controle groep. Hoewel de invoering van het systematisch assessment in het verpleeghuis is gelukt, lukte het niet om patiënten eerder vanuit het ziekenhuis te ontslaan. Er werden geen klinisch relevante verschillen gevonden tussen de groepen betreffende functionaliteit, kwaliteit van leven of tevredenheid met de geboden zorg. In vergelijking met de controlegroep werd er wel een trend ten aanzien van een vermindering van opnameduur in het ziekenhuis gezien bij die patiënten die na het assessment in het verpleeghuis revalideerden.

In hoofdstuk 5 worden de resultaten beschreven van de economische evaluatie van het nieuwe zorgmodel. De economische evaluatie was onderdeel van de niet gerandomiseerde vergelijkende studie, zoals beschreven in hoofdstuk 4. Gegevens over zelf gerapporteerde kosten en kwaliteit van leven werden gedurende een periode van 6

maanden verzameld. Kwaliteit van Leven werd met een ziekte specifiek (SASIP-30) en een generiek (EQ-5D-3L) Kwaliteit van Leven instrument gemeten. De economische evaluatie werd vanuit een maatschappelijk perspectief uitgevoerd. Onzekerheid werd middels bootstrapping en sensiviteitsanalyses gecorrigeerd. De totale kosten waren in de interventiegroep hoger (Interventie groep: mean=22009 euro, 95%CI: 21720, 22298; Controle groep: mean=19769 euro, 95%CI: 19430, 20108). De kostenutiliteitsanalyse, waarbij gebruik werd gemaakt van een generiek Kwaliteit van Leven instrument liet zien dat het nieuwe zorgmodel efficiënter was bij een "willingness to pay" van 50.000 euro per Quality Adjusted Life Year (QALY). Gebruik makende van een ziekte specifiek Kwaliteit van Leven instrument liet de kosteneffectiviteitsanalyse zien dat het nieuwe zorgmodel effectiever en duurder was dan gebruikelijke zorg. Voor zover wij weten is dit de eerste studie die de kostenutiliteit en kosteneffectiviteit van een zorgmodel gericht op vroeg ontslag uit een ziekenhuis met assessment en revalidatieplanning in een verpleeghuis onderzocht. Met een "willingness to pay" van 50.000 euro voor een gewonnen Quality Adjusted life Year, is het nieuwe zorgmodel voor patiënten met een beroerte, met een waarschijnlijkheid van 76%, kosteneffectiever. Echter op basis van deze studie alleen kunnen wij geen definitief antwoord geven op de vraag of het nieuwe zorgmodel een goede investering is.

In hoofdstuk 6 worden de resultaten gepresenteerd van een kwalitatieve studie naar de ervaringen van patiënten met het nieuwe zorgmodel. De kwalitatieve studie werd uitgevoerd onder patiënten die tussen september 2010 en januari 2011 in het Maastricht Universitair Medisch Centrum werden opgenomen na een beroerte en daarna een multidisciplinair assessment ondergingen in het verpleeghuis, als onderdeel van het nieuw ontwikkelde zorgmodel voor patiënten met een beroerte. Elk onderdeel van het zorgmodel (ziekenhuisverblijf, overplaatsing naar en verblijf in het verpleeghuis en ontslag naar huis) werd via semi-gestructureerde interviews onderzocht. Er werden 14 interviews afgenomen. De patiënten gaven aan dat over het algemeen alles goed verzorgd en georganiseerd was. Zij ervoeren geen onoverkomelijke problemen met de zorgverlening in het totale zorgtraject. Er zou echter nog? meer aandacht moeten zijn voor de communicatie met de patiënt en hun mantelzorgers over het verloop en de inhoud? van het revalidatieproces.

Hoofdstuk 7 betreft de algemene discussie van het proefschrift en laat een overzicht zien van de voornaamste bevindingen. Theoretische overwegingen, methodologische overwegingen en aanbevelingen voor de dagelijkse praktijk worden in dit hoofdstuk gepresenteerd.

Valorisation

Valorisation

In this chapter, the findings of this thesis on the development and implementation of an integrated care pathway for geriatric stroke patients which combines early hospital discharge with assessment and rehabilitation planning in a nursing home are addressed with regard to their societal relevance for the different stakeholders. In addition, the activities undertaken to further disseminate the study results are described.

It is estimated that in the coming years, the number of inhabitants in the Netherlands above the age of 65 will rise by 10%. Because of this and a better survival of cardiovascular patients, the prevalence of stroke will rise accordingly. By the year 2020, 250 per 100,000 inhabitants of the Netherlands will suffer from a stroke, often with subsequent permanent disabilities and handicaps as a consequence. This trend, combined with the Dutch government's policy of "ageing in place", aimed at keeping older adults living in their own home environment for as long as possible, will lead to an ever growing strain on acute care beds in hospitals and larger numbers of stroke patients in need of geriatric rehabilitation. In terms of costs, stroke is among the most expensive diseases in the Netherlands with a total of 1.5 billion Euros accounting for 2.2 % of total annual health care costs.

Cost effective integrated stroke care requires a high degree of coordination between professionals in hospitals, nursing homes and home care, a high quality integral assessment in the nursing home and a system of adequately timed patient transitions. Therefore, during recent years all sorts of initiatives were taken to optimise stroke care in order to satisfy the demands for care, to reduce hospital stay, start early rehabilitation, enhance patient satisfaction and to be cost effective. In the Maastricht region, this resulted in a stroke care model, aimed at hospital discharge within 5 days to a nursing home, followed by a systematic multidisciplinary assessment in a specialised nursing home assessment unit to determine the optimal rehabilitation track. Accordingly, the question remained whether in the new care model hospital stay was decreased without having a negative effect on other outcomes, such as the patient's functional level, quality of life or satisfaction with care. The focus of this thesis was to answer these questions and to depict the total costs of this stroke care model.

The results of this thesis showed that one of the main objectives of the innovative stroke care pathway, namely early discharge from hospital to a nursing home within five days after stroke, was not achieved. In the intervention group, as was intended, significantly more patients were admitted to the nursing home for assessment than in the control group. All nursing home patients in the intervention group were exposed to the nursing home assessment within 3 days after admission. There were no significant differences between the intervention and control group concerning effect measures, medical complications, hospital re-admissions or deaths between both groups. The economic analysis showed that overall costs were higher in the intervention group than in the control group. However, if implementation of the new stroke care model would actually

have fully succeeded, this might have been the preferred care model in terms of cost-utility and cost-effectiveness. A qualitative study of the new care model showed that In general, most patients stated that they were well cared for and that they did not experience any significant problems with the new stroke care model. Although, more attention should have been paid to adequate and timely communication with patients concerning their individual care pathway and privacy.

Taking all these outcomes together, this integrated stroke care model, if fully implemented, may be considered relevant and important in reducing strain on acute hospital beds, while maintaining a high quality of stroke care and being economically rational. Therefore, it is recommended to undertake additional actions to fully implement the model in a study setting again and to analyse the effects of the fully implemented stroke care model again before integrating it in regular care on national level.

Stakeholder benefits

The first group benefiting from a wider implementation of this stroke care model if implemented well, are older stroke patients for whom early supported hospital discharge to their home is not possible, due to the severity of stroke or the lack of informal caregivers at home. As expected, due to the changing demographic situation and the governmental policy of ageing in place there will be more need for temporary intramural geriatric stroke rehabilitation. This stroke care model at least has shown that it is able to offer more older stroke patients a timely start of rehabilitation with the same results.

As this thesis showed, no clinical imported differences in functional outcomes, quality of life or satisfaction with care were found between the two groups in the study. Therefore, patients that can be discharged directly from hospital to their home, should be discharged as soon as possible and continue rehabilitation by a multidisciplinary team at home. A thorough scientific evaluation of the long-term effects of early discharge with continued multidisciplinary rehabilitation in the home setting by a multidisciplinary team should be undertaken.

Another group benefiting of dissemination of the new stroke care model on a wider scale are healthcare professionals working in hospitals, geriatric rehabilitation facilities and primary care. A good cooperation between professional caregivers in different settings is mandatory in delivering high quality integrated care. The burden of high work load may be minimised by good coordination of different tasks and by performing them on the right place and at the right moment. As our study shows this is not always easy to achieve or maintain. Therefore additional efforts should be done, to improve interdisciplinary collaboration throughout the total care chain after exploring which relevant needs and barriers still are present and have to be solved.

The results in this thesis further show that making clear, binding working agreements between different care providers and care professionals, is not enough to ensure

success. Implementation is more than making agreements alone. It is equally important to constantly monitor and evaluate the care process. This may be done by appointing a stroke care coordinator, who can assure that agreements are adequately followed up, and who can monitor and control the logistics of the patient flow through the stroke care model. In addition, this process might be facilitated by relevant incentives[1].

The transition of the multidisciplinary assessment and rehabilitation treatment from the hospital to the nursing home should reduce delay by withdrawing double work and unnecessary waiting. However, our study showed that there is still double work being done, namely clinical assessments done in the hospital, which subsequently were repeated more extensively in the nursing home. This suggests even more time can be saved by better attuning the activities in both settings, which is necessary to fully implement the new model according to its physiological architecture.

This thesis furthermore shows that a well-trained multi-disciplinary nursing home team is able to accomplish a task formerly preserved for the acute setting, within the agreed timeframe. As all assessments and rehabilitation planning was carried out within 3 days of nursing home admission. To do so nursing homes must be willing to enlarge their geriatric rehabilitation capacity. To assure that a nursing home is able to receive new rehabilitation patients at all times, patient outflow, where a long-stay nursing home bed is needed, must be guaranteed. That is why in the studied model priority was given to finding a permanent bed for continuing long-term care for stroke patients that had finished their rehabilitation and could not return home.

Our study also showed the need for good, timely and continuous communication with the patient and their family caregivers about the care pathway. A case manager who follows the patient through the care pathway from hospital through the rehabilitation setting to their home and who provides timely information might be a solution for the lack of communication patients often experience[1].

Further research on the effects of both a stroke care coordinator and a personal case managers should be done as well.

The last group of stakeholders to benefit from a wider implementation of the stroke care model are health insurance companies. This thesis shows that if implementation of the intervention had been fully successful, this stroke care model was more cost-effective compared to care as usual. The cost savings would be mainly the result of a shorter length of stay in both hospital and nursing home. This finding might stimulate health insurance companies to provide temporary financial incentives to implement such a model, as mentioned earlier.

Dissemination

Next to the scientific value of this thesis, of which most chapters have been published internationally, the results of this thesis can be used to additionally raise awareness for the importance of adequately managing the future care burden of stroke.

Therefore, the outcomes of the studies were and will be presented on different (inter)national congresses and symposia. The acquired knowledge will also be used in the development of stroke care guidelines, specifically targeting frail older stroke patients.

In addition, efforts will be made to further optimize the integrated stroke care pathway in which we specifically will focus on implementation of elements of the integrated care pathway which were not fully implemented yet, and on improving elements of the pathway which were recommended by patients and informal caregivers during the initial study. Subsequently we will try to implement the model in a study setting again.

After finishing that study, a strategy for countrywide dissemination will be made.

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Dankwoord

Dankwoord

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Curriculum Vitae

Curriculum Vitae

Ron Heijnen was born on January 31th 1966 in Echt, the Netherlands. After completing his secondary education at the Bisschoppelijk College in Echt, he studied medicine at the University of Maastricht, where he graduated for his MD in 1996. In 2000 he started the post graduate medical specialization to become elderly care physician, at the Catholic University of Nijmegen.

In 2003 he was employed as elderly care physician by Burgerlijk Armbestuur, an institution for elderly care in Maastricht. After several mergers of institutions it's now called Envida. Supported by Envida, in 2009 the author started his PhD trajectory " Managing the future care burden of stroke Evaluation of an integrated care pathway including early hospital discharge with rehabilitation planning in the nursing home" at Maastricht University, under supervision of Prof. Dr. Jos Schols, Prof. Dr. Silvia Evers and Prof. Dr. Trudy van der Weijden.

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